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ABSTRACT

This guide seeks to provide a closer look at the diversity found within central Texas and the borderlands and offers a good general background to understanding some of the challenges facing the region. The book is divided into two parts with articles and lesson plans written by several authors. Part 1, "Views and Viewpoints," includes: (1) "Mexican Texas: A Distinctive Borderland" (Daniel D. Arreola); (2) "The Southern Hill Country Region of Texas" (Richard C. Jones); (3) "Along the Edge of the Hill Country: The Texas Spring Line" (James F. Petersen); (4) "Means and Extremes: The Weather and Climate of South-Central Texas" (Richard A. Earl; Troy Kimmel); (5) "Site and Situation: A Historical Geography of San Antonio" (Jeffery B. Roet); (6) "A Bicultural Geography of the Alamo" (Miguel De Oliver); (7) "Germans in Texas: Deep in the Heart of San Antonio" (Dona Reeves-Marquardt); (8) "Relocation Diffusion and the Cultural Attributes of Afro-Texans" (William R. Brown); (9) "The Border Industries Program: A Geography of Maquiladoras" (Byron Augustin; Michal Kohout); (10) "Environmental Hazards of the Lower Rio Grande Valley" (John Tiefenbacher); (11) "The Rio Grande as an International Boundary" (James F. Petersen); and (12) "A Journey through Literary Texas" (Mark Busby). Part 2, "Learning Activities," contains: (1) "The Edwards Aquifer" (Isobel Stevenson); (2) "Donde Voy (Where I Go)" (Philip Rodriguez); (3) "Circling San Antonio" (Dagoberto Eli Ramirez); (4) "New Braunfels: Reflections on a Tin-Roof City" (JoBeth Oestich); (5) "Enchanted Rock: An Outdoor Classroom" (Martha O. Bock; Frederick M. Bock); (6) "The Battle over Dolphin Bay" (Linda L. Hammon); and (7) "Drawing Political Boundaries" (Debbie Lange; Bill Sands). Contains 39 figures and 2 tables. (EH)

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Images and Encounters

James F. Petersen and Julie A. Tuason, Editors

Prepared for the 80th meeting of the
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Preface

A Geographic Glimpse of Central Texas and the Borderlands

Perhaps no region in the United States carries as much popular place mythology and stereotyping as Texas. A land of far more physical and human diversity than is generally attributed to the state, Texas is undergoing great change. Oil, ranching, and rural life are diminishing in importance, replaced by high-tech companies, white collar employment, and urbanization. Today, Texas is one of the most highly urbanized states in the union, but rural traditions persist.

Central Texas is a great crossroads of geographical transition—where the South meets the Southwest, ranching meets farming, the arid west meets the humid east, and Anglo-America meets Latin America. The central Texas region is one of fascinating gradational, yet somehow abrupt, spatial change in a state that motorists and travelers have referred to as "mile after mile of mile after mile." The true character of Texas is too often upstaged by the myth. That is one reason for producing this guide—to provide a closer look at the diversity found within central Texas and the borderlands.

We have tried to reflect this diversity in selecting the authors and topics for this guide. Fourteen authors contributed to the articles and nine authors contributed to the lesson plans. Some articles offer contrasting viewpoints in dealing with the same topic, and this divergence was intentional. We hope that this guide will yield some surprises and provide a good general background to understanding the region. We also hope that among the articles and the lesson plans educators at all levels will find useful materials and information to support their teaching.

Thanks to all individuals who contributed to this work and especially to Isobel Stevenson of the Liberal Arts Academy, Austin ISD, for her editorial assistance on the lesson plans. We very much appreciate everyone's efforts.

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Part I:

Views and Viewpoints

Mexican Texas: A Distinctive Borderland

1

Daniel D. Arreola

Texans are different, as most Americans know and as many natives of the Lone Star State insist. The political geography of Texas is also different, because the state is the only one that was ever a viable sovereign republic, and it is also the only state that reserves the right to divide itself into five separate states. It has been said that Texas is a distinctive place in our minds but a fragmented mosaic sewn on to the cultural map of America (Arreola 1993a). Scholars have dissected the internal ethnic variety of this second largest of these United States (Jordan 1986), and they now recognize that Mexican heritage has been an important ingredient in the cultural development of people and place (Montejano 1987).[1] Yet, who would assert that the Mexicans of Texas are different from other Mexicans of the Hispanic-American borderland? Aside from the so-called "Hispano Island" of central New Mexico (Nostrand 1992), are not the Mexicans of Texas, as well as those of Arizona and California, largely ancestors of emigrants who left Mexico beginning in the early twentieth century?

The simple answer, of course, is yes. Many borderland Mexicans trace their roots to migrants of an earlier era, but those pioneers emigrated from many Mexicos. Just as every Mexican claims a *patria chica* (little country or fatherland), so too can Mexicans of the Hispanic-American borderland speak of a subregional homeland (Arreola 1993b).

The Texas Mexican homeland is a distinctive borderland subregion, unlike any other U.S. state that faces the Mexican boundary. The reasons for this distinctiveness are many and complex, and they have roots in a distant past. In previously published writings, I have argued this case on the basis of place personality, townscape, and emigrant origins (Arreola 1987, 1992, 1993c). In this essay I will elaborate the issue with reference to the unusual geographic concentration of Mexicans in Texas, the peculiarity of Spanish-language habit and use in this subregion, and the great popularity of cultural celebrations among Mexicans of the state.

Texas-Mexican Rimland

In 1990, California and Texas were home to nearly ten million of the nation's almost fourteen million people of Mexican heritage (Figure 1.1). Although the Golden State counted some two million more Mexicans than Texas, California has only recently achieved its rank as the state with the greatest Mexican population. Before 1950, Texas was the undisputed demographic homeland of Mexicans in the United States. It was largely the lure of a post-war economy in California that drew thousands of borderland Mexicans from Texas and Arizona to the rapidly growing cities of southern California. In the same era, agricultural development in the counties of the San Joaquin Valley especially attracted Mexican migrants from Texas as well as from Mexico (Arreola 1985).

Despite the growth of Mexican population in California, today only one county (Imperial, in the southeast corner of the state) counts greater than half of its population as Mexican (Figure 1.2). In neighboring Arizona and New Mexico, the number of counties that are predominantly Mexican is similarly few: Santa Cruz and Doña Ana, respectively. Along the Texas border, by comparison, no less than thirty-two counties are greater than half Mexican, and twenty of these are more than seventy percent Mexican ancestry (Arreola 1993b). This proportional concentration of a single group over so vast a geographic area may make the Texas borderland the largest ethnically pure subregion of the United States, a veritable Mexican rimland along the south-central border of the United States.

This borderland cultural geography is distinctive, and it exists, in part, because of an attenuated boundary along the Rio Grande periphery and the comparatively shorter lengths of border in

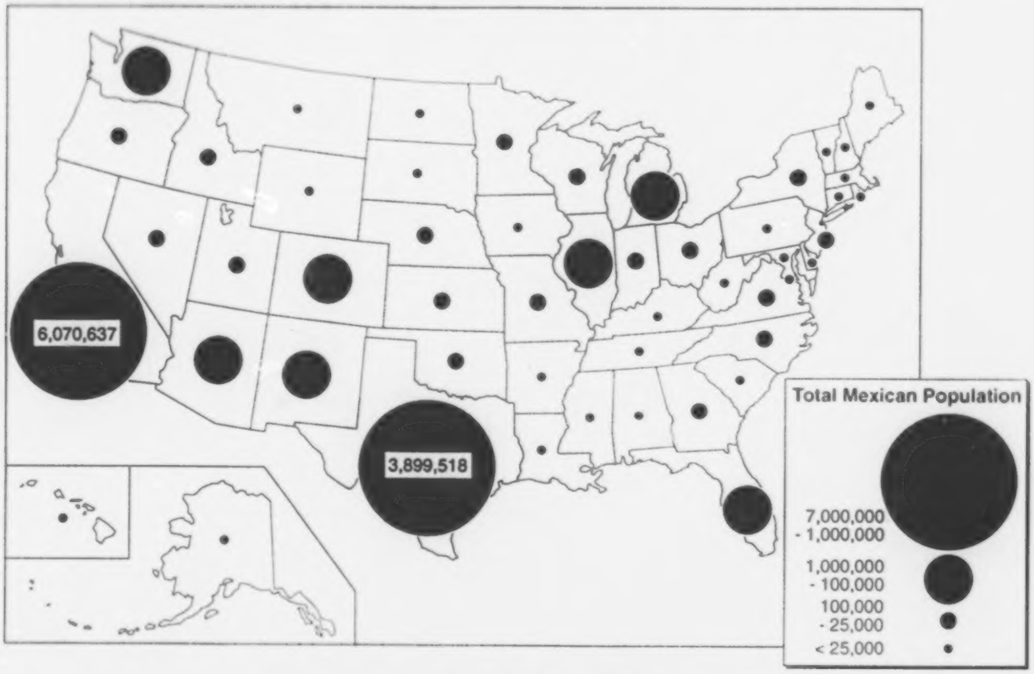

Figure 1.1: Mexican Population in the United States, 1990
Source: U.S. Bureau of the Census, 1990.

states to the west of Texas. Between El Paso, near the western end of this line, and Brownsville, close to the mouth of the lower Rio Grande, the boundary runs some twelve hundred miles (two thousand kilometers), whereas the distance west from the New Mexico-Texas junction across three states to the Pacific Ocean is less than seven hundred miles (eleven hundred kilometers) (Metz 1989). Nevertheless, boundary lines alone cannot explain this unusual geographic characteristic. The historical fix and inertia of Mexican settlement in this region and, significantly, the persistent interactions between populations on each side of the border, create a prominent subcultural area along the Rio Grande. In South Texas, for example, Mexican plaza towns, some of which date to the colonial period and others from the nineteenth century, are more numerous than elsewhere along the American side of the borderland (Arreola 1992) (Figure 1.3). In these towns, the morphology of settlement imprints a Hispanic character, which calls to mind the central plazas of towns in the homeland. Meanwhile, on the Mexico side of the Texas boundary, nine border communities (roughly half of all Mexican border towns) are linked closely by social geography and circulation to their Texas border-town cohorts. The result is a transborder Mexican rimland, where social and economic relationships bridge the international divide (Arreola and Curtis 1993; Martínez 1994).

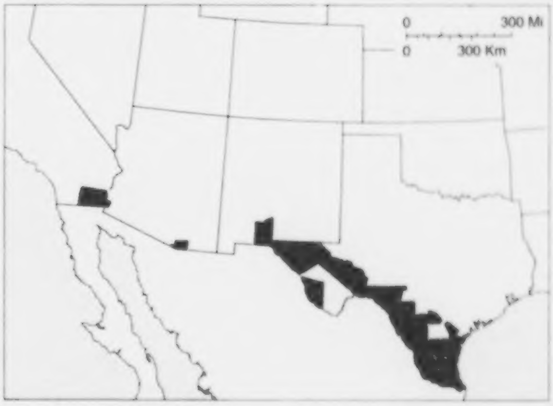

Figure 1.2: Hispanic-American Borderland Counties with Greater Than Half Mexican Population
Source: U.S. Bureau of the Census, 1990.

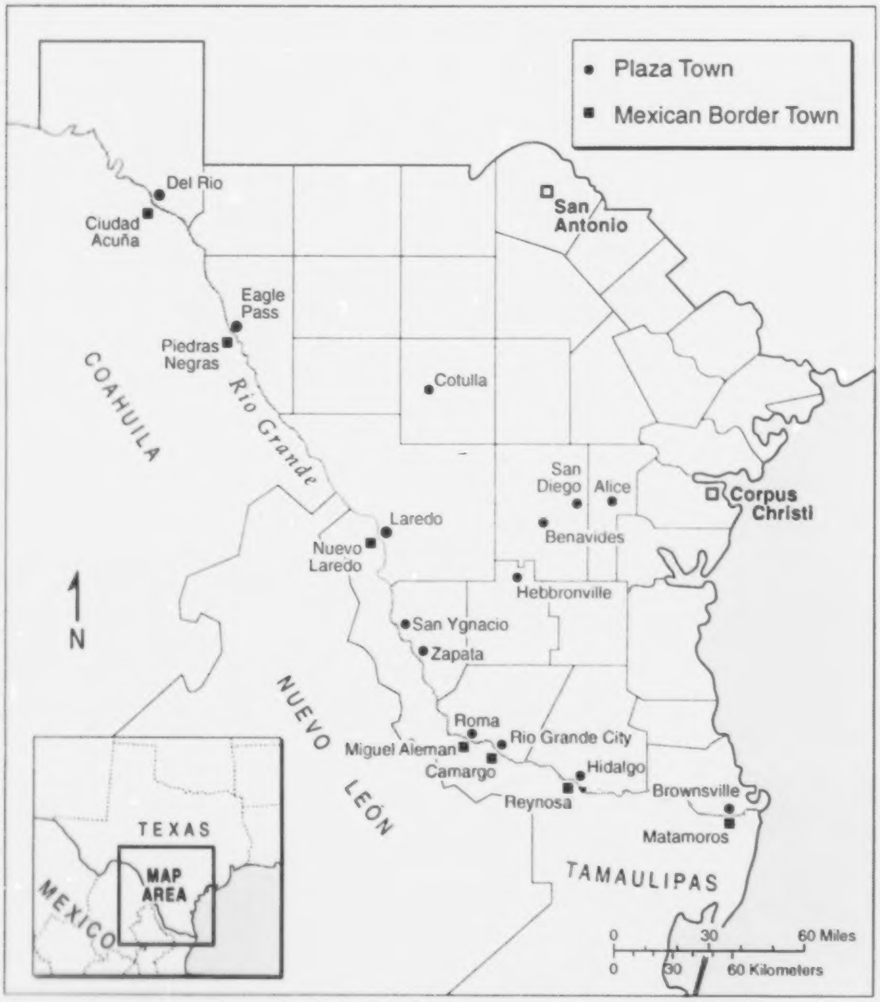

Figure 1.3: South Texas Plaza Towns and Selected Mexican Border Towns
Sources: Arreola, Daniel D. 1992; Arreola, Daniel D. and James R. Curtis. 1993.

The combination of geographical proximity and the cultural and economic bond that connects this Mexican rimland to Mexico is stronger and more complex along the Texas border than anywhere else along the U.S.-Mexico interface. A leading observer of the Texas-Mexico scene has even declared that the lower Rio Grande portion of this region is the source area for many of the elements of what we now generally assume to be "the culture of the border" (Paredes 1993, 19).

Regional Variations in Spanish-Language Use

Nowhere in the Hispanic-American borderland is the use of the Spanish language as resilient over such an extensive area as along the Texas-Mexican rimland. Only northern New Mexico comes close, but it falls short when comparing it with the geography of Spanish language use along the Texas-Mexico border, where some two dozen counties are predominantly Spanish-speaking (Figure 1.4). In California and Arizona combined, only two counties meet the same criterion.

In the first decades of this century, when emigration from Mexico was considerable, it was not uncommon for migrants to speak favorably about the Hispanic customs of Texas. An immigrant in

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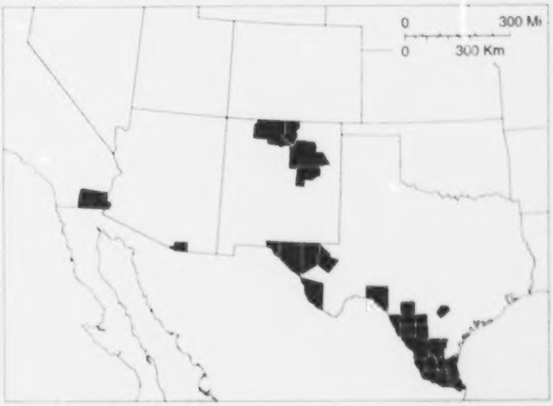

Figure 1.4: Hispanic-American Borderland Counties Where Spanish Is the Predominant LanguageSpoken at Home
Source: U.S. Bureau of the Census, 1990.

San Antonio remarked in 1918 that "I haven't been able to learn English, for I haven't made an effort to do it, and because I don't need it for anything as in San Antonio Spanish is spoken everywhere" (Gamio 1971, 64-65). More recent studies of Spanish-language loyalty confirm a heavy reliance on Spanish among Mexican Americans in San Antonio, whereas Mexican Americans in Los Angeles and Albuquerque evidence a decreasing facility for its use (see Arreola 1987).

Spanish-language maintenance in Texas, compared with other borderland states, is discernible as well from historical and contemporary media. A study of Mexican American newspaper publication in the United States between 1848 and 1958 shows that forty percent of the 380 Spanish-language newspapers that were ever published were founded and circulated in Texas, a percentage that is greater than for any other single border state, including New Mexico, which has a longer Hispanic heritage (Ríos and Castillo 1970, 1972). Texas also counts more Spanish-language radio and television stations than its neighboring border states, including California, which has more Mexican Americans (Montney 1994).

Sociolinguists agree that varieties of Spanish language exist in the southwestern United States (Christian and Christian 1966; Ornstein-Galicia 1981). Southwestern Spanish is said to derive principally from dialect zones of the Mexican northern and central high plains. Subregions exist for Texas, Arizona, California, and New Mexico and southern Colorado, although Cardenas (1975) asserted that more overlap occurs between the Spanish of Texas, Arizona, and California and adjacent areas of northern Mexico than between the Spanish of New Mexico and southern Colorado and the same northern Mexican regions (Cardenas 1975). Some 7,000 words and phrases used in the Spanish of Texas but not found in other standard Spanish-language references suggest that regional variation may be pronounced (Galván and Teschner 1975). The absence of a word in a dictionary alone, however, does not guarantee that a word is unknown in several regions. Nevertheless, lexicographers have concluded that many Spanish words in the Southwest are specific to particular regions (Carver 1987). For example, I have found that typical native Spanish-speakers in the Southwest outside of South Texas are unfamiliar with words like *chalupa* (literally, a small boat), which in South Texas is used to refer to a food item that others outside of the state would call a *tostada*. Similar differences of meaning are ascribed to Spanish words like *resaca* and *semita*, which mean a river meander and unleavened bread of the Easter holidays, respectively, in South Texas, but might refer to undertow or surf and a Semite in other Spanish-speaking regions.

The geography of Spanish-language variability in the United States is still in the infant stages of research, but known patterns suggest that subcultural differences are significant. The Spanish of the Texas-Mexican rimland is more widespread geographically and also more concentrated than at any other location along the Hispanic-American borderland. The variable meanings attached to the Spanish vocabulary of this region points as well to a distinctive subcultural identity.

Mexican Festivals

Mexican Americans celebrate a number of calendar customs, which are events associated with particular holidays, whether religious or political. Numerous Christmas celebrations, including *Las*

Posadas and *El Dia de Los Reyes*, are common in communities throughout the Hispanic-American borderland (West 1988). Political celebrations are equally popular and have been known in the Mexican Southwest since the late nineteenth century in some places, and from early in this century in others. Mexican Americans, like their brethren in the homeland, celebrate a ritual of ethnic solidarity called *Fiestas Patrias*, which is typically focused on Mexican Independence Day (September 16), and *Cinco de Mayo*, which honors the victory of the Mexican forces over the invading French army in Puebla in 1862 (Melville 1978).

When calendar customs become events celebrated regularly by an entire community, they become festivals. In the Mexican-American Southwest, some calendar events now attract considerable attention among non-Hispanics and thus become a community celebration. For example, Mexican Americans in towns and cities across the United States celebrate *Cinco de Mayo*, and these celebrations often involve festivities in which non-Mexicans join.

Hispanic festivals are more common in the Texas-Mexican borderland than elsewhere in the region (Graham 1989). San Antonio, a city especially famous for its lively fiestas, is host to some eighteen regular Hispanic celebrations annually, making the city the recognized capital of such festivities not only in Texas but also in the United States. At least forty-seven places in Texas presently host Mexican festivals, with the greatest concentration in South Texas (Figure 1.5).

In most towns that celebrate Mexican festivals, the *Diez y Seis de Septiembre* (Mexican Independence Day) and the *Cinco de Mayo* are the most common and best recognized. Nevertheless, many towns also host specialized festivals that honor events like a saint's day or some specific local activity, as well as general Hispanic heritage celebrations. In some towns, a Mexican patriotic fiesta might be renamed with a local moniker to appeal to a greater audience. For example, Lubbock's Fiesta del Llano uses part of the place-name Llano Estacado for its Hispanic community celebration that honors Mexican independence in mid-September.

Brownsville, a city of 100,000 in the Lower Rio Grande Valley, has celebrated Charro Days every February since 1938. The festival was organized to educate local residents and visitors to the Mexican culture of the Brownsville-Matamoros (Mexico) area. Typically, the festival occurs over several days at multiple locations and features music, food, and folk-art displays of the South Texas border area. Major attractions include a *charreada* (Mexican rodeo) and a costume review of traditional Pan-American dress styles. Charro Days attracts more than 150,000 participants yearly (Simon and Hoyt 1992, 235).

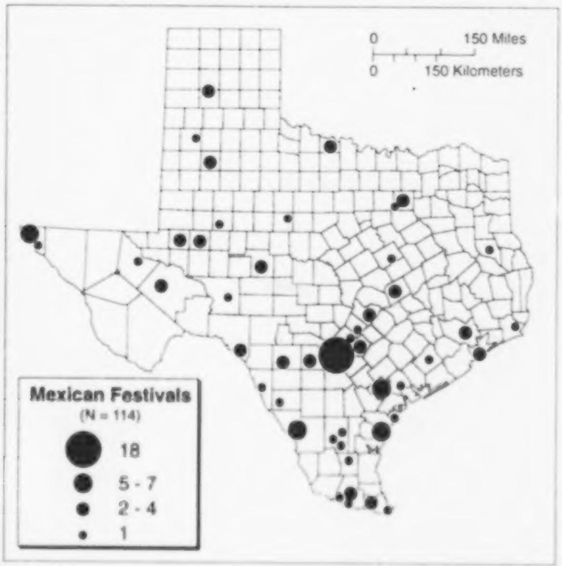

Figure 1.5: Texas Towns That Celebrate Mexican Festivals, 1992
Sources: Graham, Joe S., comp. 1989; Simons, Helen and Cathryn A. Hoyt, eds. 1992.

San Diego, a small town of five thousand residents located in the South Texas plains west of Corpus Christi, celebrates the annual Pan de Campo Fiesta every August (Figure 1.3). This weekend event is staged on Plaza Alcalá, one of two public plazas in the town. Fiestas have been seasonal events in San Diego since the late nineteenth century, when ranching and cotton farming became primary economic activities. Today, the Pan de Campo attracts some six thousand visitors annually, more people than the town's resident population. Activities include traditional music like *conjunto* (accordion musical combo), dances, folk arts and crafts, games, and *tejano* (Texas Mexi-

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can) foodways. The central competition of the fiesta is the famous *pan de campo* (country baked bread) cooking contest (Arreola 1993d, 86).

Conclusion

Population concentration, Spanish-language use, and festival celebrations all suggest that the cultural geography of Mexicans in Texas varies significantly from that found in other borderland states. Mexican Texas is part of the larger Hispanic-American borderland region, but it is also a distinctive borderland, with its own subcultural heritage and regional identity.

Note

[1] In this essay, I use "Mexican" and "Mexican American" interchangeably to refer to people of Mexican ancestry, regardless of nationality.

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2 The Southern Hill Country Region of Texas

Richard C. Jones

> Texas in our view is a border province, where are joined Anglo-America and Latin America; the Bible Belt and Roman Catholicism; South, West, and Midwest; plains and mountains; forest and prairie; farmer and rancher; urban and rural; humid subtropics and desert (Jordan, Bean, and Holmes 1984, 5).

Despite the popular national image of a Texan subculture, closer inspection reveals great diversity within the state—a land divided culturally and physically along many different lines. These lines cut all across the state, and more of them cross the Southern Hill Country than any other region.

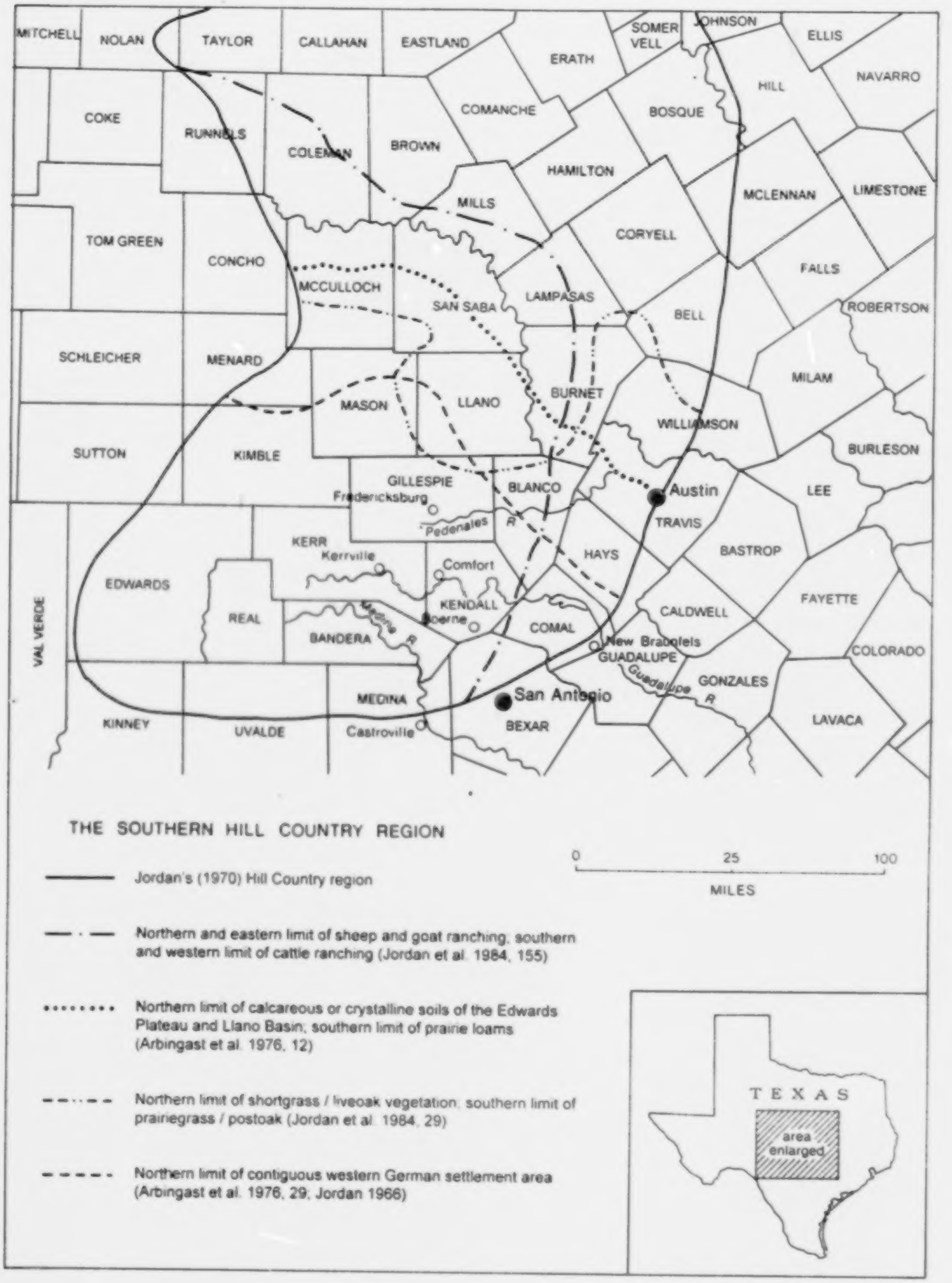
The Texas Hill Country, as defined by Jordan (1970), extends as far south as the Balcones Escarpment in Kinney County near the Mexican border and Bexar County at San Antonio, northward to the Oklahoma border (Figure 2.1). Its boundary (except for the short stretch along the Oklahoma border) is a physical one, within which local topographic relief exceeds three hundred feet (ninety-one meters) and hills stand out markedly from adjacent plains and tablelands (Arbingast *et al.* 1976).

Separating the northern and southern Hill Country is more difficult, because no discernible topographic break separates north from south. Rather, a transition zone becomes visible only when we consider such factors as settlement history, rural economic geography, soils, and vegetation. The western German settlement area centers upon the Southern Hill Country (Jordan 1966). Northward, the settlement landscape becomes overwhelmingly old-stock Anglo, tracing its roots to Tennessee by way of Arkansas (Jordan 1970). Economically, to the south and west, sheep and goat ranching predominate, whereas to the north and east, cattle ranching prevails (Jordan, Bean, and Holmes 1984, 155). Physically, to the north, we find reddish-brown loamy soils, short grasses, and clumped oaks typical of prairie landscapes; to the south, we encounter the stony, calcareous or crystalline soils, thorny scrub and live oak of the Edwards Plateau and Llano Basin. Not only one boundary separates north and south, but many. The north-south layering of these boundaries suggests a kind of ecotone. For simplicity, since the soils boundary splits the ecotone across the middle, I use it to define the northern boundary of the Southern Hill Country region.

Physical Geography

The gently rolling, bucolic, geologically stable nature of the Southern Hill Country landscape belies a tumultuous geologic past. This past has influenced its present-day economic geography. Sheep and goat ranches, peach orchards, granite and limestone quarries, and summer and retirement homes would not be here but for an enabling physical environment. Rather than a dictator, however, the environment has served as an overseer, sanctioning certain activities while discouraging others.

Geologically, the Southern Hill Country is essentially two regions—an igneous north and a sedimentary south. A journey through geologic time illustrates how this differentiation came about (Spearing 1991, 3-11). From Gillespie County northeastward (Figure 2.1), the Precambrian Era saw collision of two continental plates along what is today the Balcones Escarpment (Figure 3.1), resulting in intrusive vulcanism in the form of large granite batholiths and stocks (Petersen 1984), which today provide the unique pink granite that adorns large buildings all over the state. Individuals are also dying to get it; i.e., it is popular for tombstones. Enchanted Rock, an exposed "pimple" on the Enchanted Rock Batholith, is a 445-foot-high (136 meters) exfoliation dome in northern Gillespie County. It has become one of the most popular state natural areas and a mecca for hik-


MITCHELL
NOLAN
TAYLOR
CALLAHAN
EASTLAND
ERATH
SOMERVELL
JOHNSON
ELLIS
NAVARRO
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BOSQUE
COMANCHE
COKE
RUNNELS
COLEMAN
BROWN
HAMILTON
MILLS
MCLENNAN
LIMESTONE
TOM GREEN
CONCHO
CORYELL
FALLS
MCCULLOCH
SAN SABA
LAMPASAS
BELL
ROBERTSON
SCHLEICHER
MENARD
MILAM
BURNET
MASON
LLANO
WILLIAMSON
SUTTON
KIMBLE
BURLESON
GILLESPIE
Fredericksburg
BLANCO
Austin
LEE
TRAVIS
Pedenales R
KERR
Kerrville
Comfort
HAYS
BASTROP
EDWARDS
KENDALL
Boerne
CALDWELL
FAYETTE
VAL VERDE
REAL
BANDERA
COMAL
New Braunfels
GUADALUPE
COLORADO
Medina R
Guadalupe R
GONZALES
MEDINA
San Antonio
KINNEY
UVALDE
Castroville
BEXAR
LAVACA
THE SOUTHERN HILL COUNTRY REGION
0
25
100
MILES
Jordan's (1970) Hill Country region
Northern and eastern limit of sheep and goat ranching; southern and western limit of cattle ranching (Jordan et al. 1984, 155)
Northern limit of calcareous or crystalline soils of the Edwards Plateau and Llano Basin; southern limit of prairie loams (Arbingast et al. 1976, 12)
Northern limit of shortgrass / liveoak vegetation; southern limit of prairiegrass / postoak (Jordan et al. 1984, 29)
Northern limit of contiguous western German settlement area (Arbingast et al. 1976, 29; Jordan 1966)
TEXAS
area enlarged

Figure 2.1: Delimitations of The Southern Hill Country Region

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ers and rock climbers from hundreds of miles around. The crystalline rock degrades into a quartzy loam, which, in river bottomlands, is especially favorable for growing peaches. Later, in the Mesozoic Era (specifically, the Cretaceous Period), as the Rocky Mountains were uplifted to the west, shallow oceans covered much of Texas as they did the whole interior United States, and the shells of crustaceans were deposited to form thick layers of limestone. During the Cenozoic Era, these layers were dramatically uplifted more than two thousand feet (six hundred meters) by continental-drift pressures from the west.

These geological processes formed the Edwards Plateau region of today. This plateau is especially well-represented southward and westward from Gillespie County. The Edwards Plateau is noted for its semi-arid vegetation and stony soils, which support short grasses and oak trees but scant agriculture—a land chiefly suitable for grazing sheep and goats. Along the Balcones Escarpment, a normal fault separating the Edwards Plateau from the South Texas Plain, we find a plethora of hilly, desirable residential settings, particularly in the outskirts of San Antonio, Austin, New Braunfels, and San Marcos, where middle- and upper-class couples from Texas metropolitan areas (and occasionally from out of state) have built recreational and retirement homes.

Climatically, the Southern Hill Country region lies astride the 28-inch (71 centimeter) isohyet, which separates the humid subtropics east of Fredericksburg from the dry subtropical steppe to the west (*Texas Fact Book* 1989, 54; Jordan, Bean, and Holmes 1984, 25). Interestingly, the Balcones Escarpment, rising a thousand feet (three hundred meters) over distances from twenty-five to fifty miles (forty to eighty kilometers), orographically intercepts the moist maritime-tropical air from the Gulf of Mexico, causing cities such as Kerrville and Boerne to have higher annual precipitation totals than San Antonio, which is located east of them. Sudden rainfall episodes in the Hill Country often cause disastrous flooding. Naturally, such cities are also cooler by several degrees than San Antonio or Austin; whereas San Antonio receives snow flurries only once every three years on average, the Hill Country receives them almost every year.

The weather in this region is not tranquil. Meteorological disasters are frequent. Located at the southernmost end of the Great Plains, and relatively low in relief, it is a corridor for the transmission and occasional meeting of continental-polar and maritime-tropical air masses originating hundreds and thousands of miles away. The third-most severe Texas tornado according to the number of lives lost was the Edwards County tornado of April 1927, which leveled Rock Springs and killed seventy-two people (Bomar 1983, 133, 229). More important are the flooding episodes stimulated by tropical storms and hurricanes. Hill Country uplands intercept moisture-laden Gulf air from the south, resulting in orographic precipitation. When a tropical depression moves into the Hill Country, the small stream channels cannot contain the resultant deluge, and flash floods result. Flooding is especially severe in the eastern part of the region. In Austin alone, devastating floods have occurred in 1900, 1921, 1960, 1974, 1975, and 1981; whereas to the west, deep in the Hill Country, memorable flooding years include 1919, 1921, 1932, 1952, 1959, 1979, 1985, and 1987. No Hill Country weather event within historical record can compare with the unforgettable flood of early August 1978.

On Monday, July 31, 1978, a weak depression (Tropical Storm Amelia) moved inland from the Gulf of Mexico, settling along the upland border between Bandera and Kendall counties (NOAA 1979). It would have dissipated with moderate drizzles, had not strong upper-air winds and an upper-air trough developed. This trough drew moist surface air upward dramatically and continuously for twelve hours beginning late Tuesday afternoon, August 1. By the early hours of August 2, the unremitting downpour had filled creek and stream beds, parched dry from a near-record drought, reached flood stages over much of the region. Twenty-seven people died in the Southern Hill Country on August 2, 1978, most of them very young or old, in or close to mobile homes. More than a hundred and fifty homes were destroyed. Thirty-inch (seventy-six centimeter) isohyets for the August 1-2 period centered over central Bandera and central Kendall counties—an entire year's equivalent of rainfall in only half a day. The inexorable force of the advancing flood waters, laden with debris and tree trunks, was felt along the Medina and Guadalupe rivers in Bandera and Kendall counties, respectively. The Guadalupe, normally little more than a creek in this area, swelled fifteen-hundred-fold to the volume of the Ohio River, and reaching one mile (1.6 kilometers) in width. The highest flood crests were experienced where the stream bed was narrowed by steep slopes. Near Camp Bandina in western Bandera County, the Medina River rose to an incredible sixty-five feet (twenty meters) above its normal pool level, in such a topographic funnel.

Cultural and Historical Geography

The Southern Hill Country includes the western German settlement area in Texas (Jordan 1966). German culture profoundly influenced its language, religion, ethnicity, political voting behavior, and livelihoods. Physical-environmental filters and cultural assimilation have, however, also influenced traditional German cultural practices. Germans are not the only cultural group in the region. Old-stock Anglo populations dominate its western half. Historically, Native Americans, Spanish, Mormons, and Mexican Americans have played important roles.

The region's prehistory centers around archaeological findings made in 1982 at Leander, in the northeast corner of the region, that pushed its paleo-Indian history back at least nine thousand years (Office of the State Archaeologist 1983). In late prehistoric times, this was the haunt of the Tonkwans, a timid nomadic group who roamed with the buffalo, like the Plains Indians to the north, and gathered plant food and hunted small game, like the Coahuiltecans to the south (Newcomb 1961, 133-53; Arbingast *et al.* 1976, 43). The Tonkwans were in full decline by the eighteenth century, because of introduced diseases and the onslaught of the Comanches. Numerous Indian campsites dot the region, indicating that features such as Enchanted Rock may have held religious meaning for prehistoric Indians; more than two hundred archaeological sites exist near Enchanted Rock alone (Petersen 1984).

The region was wild and difficult for the Spanish, and lacked fertile soil. It served as a safe haven for Apaches and Comanches. It was largely a corridor northwestward to New Mexico and (for a short time) to the San Saba Mission. Its historic corridor function is suggested by the Spanish Pass area near Welfare and by Cross Mountain just north of Fredericksburg—the site of a wooden cross erected as a guidepost by Spanish expeditions.

The Anglo-stock population of the Southern Hill Country, which traces its origins to Tennessee by way of Arkansas, began to establish itself after Texas gained independence from Mexico in 1836 (Arbingast *et al.* 1976, 30; Meinig 1969, 28-37). This population established itself in a "Texan Appalachia," which is most strongly associated with the northern part of the Hill Country region, but whose influence is found in the south as well (Jordan 1970). Jordan (1993) referred to the Southern Hill Country as a "seam" between Anglos and Mexicans in Texas, although it is more closely oriented to the former (Jordan 1993). The western part of the region is within the "Anglo-Texan homeland," identified by a self-conscious, siege mentality owing to perceived encroachment by alien cultures over the past hundred and fifty years (Jordan 1993). This attitude is less pronounced in the cosmopolitan eastern part of the region.

Embedded within the Southern Hill Country are remnants of other Anglo populations—English farmsteaders, such as Alfred Giles, a famous nineteenth-century San Antonio architect who later settled near Comfort; and Mormon settlers, such as Lyman Wight and his flock, who settled briefly on the Pedernales River near Fredericksburg and later at Lake Medina in Medina County (Comfort Heritage Foundation 1990; Maverick 1980).

German culture embodies the regional character most strongly. This character persists today, one hundred and fifty years after the arrival of the first German settlers. It is seen in the use of the German language in many homes and businesses, the predominance of Catholic and Lutheran churches, the conservative (Republican) voting behavior, the architecture of homes and businesses, the crops and animals raised, and in many other features of the modern landscape.

German culture in the region, however, includes many examples of diversity. Alsatians settled in Castroville (1844), Hessians and Lower Saxons in Fredericksburg and New Braunfels (1844 and 1845), and Prussians in Comfort (1854) and other sites on the upper Guadalupe River. The upper Guadalupe settlers, adherents of the free-thinker philosophy, were college-educated urbanites who came for political reasons (the War of 1848 in Europe). The other settlers were agriculturalists who came for mixed economic and cultural reasons (particularly, wheat blight and famine in central Europe) and were sponsored by emigration societies. Even today, profound cultural differences exist between the Comfort-area, free-thinking German settlements, and the Fredericksburg-area agrarian settlements. For example, because of their educated, agnostic backgrounds, the descendants of free-thinking communities speak a purer form of German, are less overtly religious, and are more demanding in their public-education standards than their agrarian counterparts.

Fredericksburg, the reservoir today of German cultural values in the Southern Hill Country, merits detailed attention. Fredericksburg and New Braunfels were dual anchors of the western end of the German Belt in Texas. The eastern end, which was settled earlier, lay south of the city of Brenham (northwest of Houston). Fredericksburg is named for Prince Frederick of Prussia, a member of the *Adelsverein* (the Society for the Protection of German Immigrants in Texas). This organization planned and financed German settlement in the state. German settlement as far south as Texas was exceptional. The Germans (as did other Europeans) pointedly avoided the American South because of an aversion to slavery and an environmental preference for the Midwest. However, Texas offered strong incentives in the form of cheap and abundant land, and a relative absence of slavery (Richardson, Wallace, and Anderson 1970, 115-123).

The original land granted to the Adelsverein (the Fisher-Miller Grant) began some seventy miles (113 kilometers) northwest of Fredericksburg, on the North Llano River near Junction in Kimble county(Jordan 1966). The Adelsverein wished to create two way stations between the Gulf of Mexico and its grant. New Braunfels was founded in 1845, and a year later a band of a hundred and twenty settlers left New Braunfels to found Fredericksburg, sixty miles (ninety-seven kilometers) to the northwest. As it turned out, the Fisher-Miller Grant was never permanently settled, owing to its isolation, infertile soils, and a conflict over the Adelsverein's right to the land (Fisher and Miller had forfeited title to the state of Texas prior to selling to the Adelsverein). By the time this problem was straightened out, settlers in Fredericksburg had become sufficiently established that they did not savor the likely tribulations of another move west.

Fredericksburg's site, just north of the Pedernales River, was close to relatively flat, fertile farmland and to supplies of cedar, oak, and limestone. The Germans located their settlement wisely, a few miles north of the floodplain. The Mormon settlement of Zodiac, founded on the Pedernales River in 1847, was destroyed by a flood. This event did not happen before the Mormons were able to teach the Germans valuable lessons in agricultural techniques suitable for the semiarid Southwest (Maverick 1980).

Separation of the best farmland from the town led indirectly to the famous "Sunday houses" in Fredericksburg (Jordan 1966; Kowert 1977). Under the arrangements of the Adelsverein, settlers were granted half-acre (0.2 hectare) plots in town, ten-acre (four hectare) plots for raising crops close to town, and larger farms outside. The settlers built log or frame dwellings on both their town and rural plots, but they soon replaced their rural homes with more substantial ones made of stone. Sunday houses were simple two-room affairs, with a kitchen and living area below and sleeping quarters above. Such a settlement pattern reversed the traditional German arrangement of agricultural hamlet (where people lived) and outlying farm plots; such an arrangement was not suitable in Texas, given the large plots and long travel distances, in addition to questions of security. The term "Sunday house" is appropriate, because a family traveled (by oxcart) to Fredericksburg on Saturday to shop and visit with friends, and stayed overnight to attend church services on Sunday. Family members also used Sunday houses for extended stays to receive medical attention from the town physician. Today, remodeled versions of these miniature houses, some rented out as bed-and-breakfast lodgings, appear throughout the town. Merchants, wagoners, butchers, and other business people, as well as community leaders built more elaborate, permanent residences in town.

German adapted their architecture to the Texas environment. After the initial log structure, a family frequently constructed a permanent dwelling of cross-timbered masonry (*fachwerk*), in which they used wooden beams to strengthen the structure. Later they built additions to houses, as well as new homes, of larger limestone blocks without cross-timbering, as settlers discovered that the local stone was sufficiently strong and did not require additional supports to their structures.

The most important adaptations the Germans made to their new environment were agricultural (Jordan 1966, 118-191). Settlers initially grew apple, cherry, peach, and pear trees; a variety of garden vegetables; wheat and rye; German grape vines; and white potatoes. They practiced dairy farming for cheese and butter, and raised cattle for meat. Many of these products became important commercial items in early years, notably in their trade with Fort Martin Scott, a few miles south of the town. Colonists bartered products for coffee and sugar, or sold them outright for cash. This trade stopped abruptly when the federal fort was closed in 1852. In time, the climate proved too hot and dry for cherries, pears, and apples, as well as for German grapes and wheat. The settlers, aided by the Mormons, then switched to corn as their chief grain for food and feed; began to grow sweet potatoes; introduced sheep, becoming the first practitioners of mixed sheep-and-cattle ranching in the state; began to produce wine from the local grapes and berries; and even switched to growing cotton and tobacco as cash crops. They retained only a few of their initial crops (peaches, rye, white potatoes, livestock, and some garden vegetables) after this initial period of experimentation. They also quickly abandoned typically intensive Germanic methods in favor of the extensive dryland practices of Anglo settlers, though Germans quickly became more efficient at it than their forerunners. Today, livestock grazing, especially of sheep and cattle, is the chief agricultural activity in the German Hill Country. Peaches are a second important source of income, and orchards cover the undulating floodplain of the Pedernales River to the south, with its sandy soils derived from the Llano Uplift to the north.

The German Hill Country is undergoing cultural change, especially in the increasingly suburbanized cities such as New Braunfels and Boerne. The distinctive architecture, horticulture, and mixed goat-and-sheep ranching are giving way to standardized urban sprawl. Each year, over the region as a whole, fewer and fewer native German speakers are around to carry on the traditions. Tex-German language (*aufrounden* for roundup, *greasen* for grease, *gejumpt* for jumped, *der Pickupwagen*, and so on) has emerged (see Jordan, Bean, and Holmes 1984, 103). The ethnic composition of the region is changing, and with it the power base in local government and in the schools. For example, Hispanic-surnamed people now constitute some 20 percent of the region's population, and they are beginning to exert their influence in local politics.

Economic Geography

The Southern Hill Country boasts economic activities uncommon elsewhere in the state: angora-goat ranching, granite quarrying, exotic game hunting, vineyards and peach orchards, and German cultural attractions. It is also an area in transition from traditional primary activities to yuppified tourism (catering to young, urban professionals), recreation, and retirement.

The value of granite quarried has increased in recent years. Texas pink and red granites are in high demand for buildings all over the United States (and recently, the world, including Mexico and several countries of East Asia). Numerous small- and medium-sized quarries dot the outcrops of the Granite Mountain Batholith in Burnet County and the Enchanted Rock Batholith in Gillespie and Llano counties, benefiting from expanding exports as well as rising domestic prices for other building materials, such as structural steel (Garner 1992). Much Hill Country production is concentrated in the eight quarries of the Texas Granite Corporation, headquartered in Marble Falls (Burnet County), where they use capital-intensive techniques, such as wedging with quick-expanding lime and cutting with diamond-wire saws in conjunction with blasting to remove the stone. Thirty-ton blocks, each worth some thirty thousand dollars in finished form, are fork-lifted onto trucks and transported to the finishing plant at Marble Falls, where they are cut, ground, and polished.

With its peach, apple, and grape orchards, the Southern Hill Country has taken on a decidedly Mediterranean flavor. In Gillespie County, where some twenty percent of Texas peaches are raised, peaches are second only to cattle in income from agriculture. The variable climate here is not as ideal as that in central California, but the combination of sufficient winter cold (*cumulative* *chilling hours*) to prevent overbranching and premature budding, and a paucity of damaging late-spring frosts, make peach raising quite profitable. Soils here, moderately acidic, are ideal for peaches. Another favorable factor is the proximity to San Antonio, because almost fifty percent of the peaches are sold directly to visiting tourists, and much of the rest to the HEB supermarket chain, headquartered in San Antonio. Apple orchards, begun in 1979 and concentrated in Bandera, Burnet, and Uvalde counties, benefit from the drier climate, which makes them thirty percent sweeter than apples grown in Washington. The major problems are diseases, such as cotton root rot, which can wipe out half the crop in a single season. The verdict on long-run production of Hill Country apples is still pending. Vineyards and wineries are also springing up in the region. These appeal to the weekend tourists who want to taste and take home some local wines. Gillespie County already has three wineries.

Ranching epitomizes Texas, in its popular image both today and historically. With the exception of cattle, the number of livestock in all categories has decreased over the last forty years in the state (and with cattle, it is feedlot cattle, not range cattle, that are on the rise). Under pressure from other land uses, sheep and goat production have both decreased and moved westward onto more barren parts of the Edwards Plateau including Edwards, Val Verde, and Crockett counties (the latter two are located outside the Southern Hill Country region). Though sheep outnumber goats three-to-one in Texas, it is the angora goat and its mohair that distinguishes the state from all others in the U.S.

More than ninety-five percent of the nation's mohair, and perhaps one-fourth of the world's, comes from the Hill Country and Edwards Plateau regions. Mohair, especially from the angora kid, is acclaimed by many to be the finest wool obtainable. Demand is almost exclusively a function of style changes in the luxury-garment market. South-Central Texas has several important benefits for angora-goat raising, namely: (1) large spreads of relatively inexpensive land; (2) a plentiful and preferred natural food source—the leaves of the shin oak and live oak; (3) a mild climate, important because of the extreme sensitivity of the angora to cold and wet conditions; and (4) the availability of good, plentiful water.

The goats browse and graze for much of the year, getting supplemental feed in the winter and at breeding and kidding time. A number of ranchers enclose their animals in pens for a good part (or all) of the year as protection against weather and predators. Goats are sheared every six months (generally in February and August), because that is the time required for the wool strands to grow to the optimal five to six inches (thirteen to fifteen centimeters) in length. Enclosed pens protect newborn kids. Farmers prefer to use drinking water for their stock obtained from pumps and stored in open concrete tanks to that obtained from ponds, which breed stomach worms in their muddy margins, and which drain rapidly into the porous rock. Goat herds run from a couple of hundred animals, one to an acre, in the eastern margin of the angora area (Kendall, Blanco, and Llano counties), to two or three thousand animals, each needing six acres (two-and-a-half hectares), in the western area of Real, Edwards, Val Verde, and Crockett counties.

Despite the many advantages, there are also increasing disadvantages, which may eventually lead to the demise of the industry. Mohair prices are extremely susceptible to style changes, to the costs of substitutes, and to competition from abroad. From a market price high of four dollars per pound for adult wool in the late 1970s, when petroleum (and thus, synthetic substitutes) cost more, adult mohair dropped to only seventy cents per pound in 1993, because of declining prices for substitutes and to competition from countries like South Africa, Australia, and New Zealand. Angora-goat ranchers today cannot meet their production costs. In 1993, goat ranchers depended on federal subsidies ("incentives") under the 1957 Wool Act for half of their ranching income. In that same year, the U.S. Congress voted to phase out these subsidies—to seventy-five percent of current subsidy levels in 1994, fifty percent in 1995, and zero percent in 1996. Without a dramatic improvement in the market, most ranchers will not survive this economic retrenchment. Many are now selling goats as meat to markets in Mexico and the Caribbean. Some are pursuing other uses of their ranches, seeking alternative employment, or getting out of ranching altogether.

Urban development is pushing goat ranches westward. Developers are purchasing and dividing ranches into five-acre (two hectare) subdivision or summer-home plots for wealthy urban dwellers from Dallas, Houston, San Antonio, and out of state. Property taxes on practicing ranches located adjacent to urban areas are up to five times higher than those on isolated spreads, despite county tax relief in the form of lower taxes when ranchers gets more than fifty percent of their income from agriculture or herding. Furthermore, town dogs often prey on kids and young sheep. Farther west, ranchers must face wild predators such as coyotes and eagles. Ranchers use Border collies and Great Pyrenees to herd and protect their charges from predators, but recently, another guard animal has been found more effective and cheaper: the burro. Interestingly, the donkey is a very social animal. One astonishing (yet plausible) theory for its effectiveness is that up on the lonely plateau, it gets so desperate for friendship that it quickly attaches itself to the goat herd, becoming the herd's protector in the process (Kerr County Historical Commission 1986, 105).

Hunting, especially weekend hunting from nearby urban areas, is big business in the region. Many ranchers in the Southern Hill Country lease their land to companies, clubs, and private individuals for hunting deer, a practice referred to as "deer leasing." In recent years, exotic species (sika, axis, fallow deer, and blackbuck antelope being among the most numerous) have been stocked on many ranchers' lands. These animals do well in the Hill Country climate, which resembles that of their native Africa, Asia, or southern Europe. Since they were first introduced by the Friedrich family of San Antonio to the Rickenbacker Ranch near Kerrville in the 1930s (Kerr County Historical Commission 1986, 106-7), the exotics—surplus progeny from legally imported zoo animals—have become popular with hunters and profitable for ranchers. Today, a blackbuck hunt may cost as much as fifteen-hundred dollars. Controversy surrounds exotic hunting, however, because it is not licensed by the state (and is thus outside state regulation), and because it presents questions of fairness to the animals. In response to the latter complaints, an Exotic Wildlife Association has been formed, and ranchers who join agree on "fair chase" rules for hunting exotic animals. Deer leasing and exotic-game hunting both provide sources of supplemental income for ranchers, and they preserve the ranching way of life, because ranchers and their families retain the right to run stock or cultivate their acreage and hunt on it. Occasionally, a family rents out lodgings, vehicles, and its own services; the ranch thus becomes a mini-resort. In addition to these direct benefits to residents, hunters buy gasoline, food, and other supplies from local businesses in nearby towns and urban centers.

When we add hunting to the income from resort (dude) ranches, retail and service activities, motels, the sale of residential land to outsiders, commuting to work in urban centers, it is evident that the majority of Southern Hill Country income comes from tertiary (service) industries rather than primary (extractive) activities. Most of the population of the Southern Hill Country today lives in communities that can be termed *recreational-retirement centers*, or communities in transition from farming and ranching to recreation and retirement (Davidson 1987). The types of businesses that prevail in the R&R (recreation and retirement) and transitional communities include: health and professional services (hospitals, doctors, nursing homes, drugstores); recreation and leisure-related stores (crafts and art shops, movie theaters, sporting-goods stores, travel agencies); and real-estate and construction businesses. The small, rural-rooted communities at the western margins of the region specialize in convenience items (food stores, restaurants, barbershops) and farm supplies (equipment, feed, fuel).

Kerrville, the growth center of the Southern Hill Country with a population of close to twenty thousand, is the largest interior city of the region. It is the principal central place for communities in the rural periphery. At the same time, Kerrville also has one foot in the urbanized east. It has become a tourist and retirement center with hunting, art shows and air shows, lodges and guest ranches, a major hospital, and banks and travel agencies, many of which owe their success to the increasing number of retired residents.

Summary and Conclusion

The Southern Hill Country region is the most important seam in the fabric of Texas. Simultaneously it is a region of physical transition, a cultural frontier, and an economic tributary area. Its most distinguishing characteristics also make it a land of three Gs: granite, Germans, and (angora) goats.

Topographically, the Southern Hill Country region is the corrugated zone of transition between two somewhat featureless regions—the Edwards Plateau to the west and north, and the South Texas Plain to the east and south. The landscape's tranquillity hides a violent past and an occasionally violent present. In Precambrian times plate tectonics forced a gigantic hinge upward, allowing molten granite to ooze upward. In late-Mesozoic times, again activated by tectonics, a series of faults allowed the Edwards Plateau to rise above the South Texas Plain. Today, the granite has hardened and the uplift slowed. The region still has its surprises, for every few years it intercepts the rainfall from a severe tropical storm, resulting in orographic downpours and flash flooding.

Economically, the Southern Hill Country now functions as a tributary region or hinterland to San Antonio and Austin, located to the east. Residents of these metropolitan areas (with a combined population of nearly two million) venture into the region to stay in historic bed-and-breakfast cottages, shop in craftsy malls, attend cultural events, buy peaches, hunt and camp, buy land, and sometimes retire. Even Kerrville's economy is oriented more to its metropolitan patrons to the east than to its rural western hinterland. The inexorable western march of location-rent isolines and urban land uses are forcing angora goat and sheep ranching ever westward.

The crucial challenge for this region is whether it can absorb all the metropolitan influences and still retain its unique cultural and economic institutions. With in-migration, old German culture (including language, commemorative events, and house styles) is dying. With urban pressures and expiration of the Wool Act subsidies, angora-goat ranching may disappear altogether. Native whitetail deer-leasing sites are becoming scarce, and they are giving way to exotic-game hunting. Some of this change is inevitable; however, one would ideally like to see more museums, stronger local historical-review boards and historical societies, and efforts to create more public parks and relict farms to preserve the unique lifeways of this region. Only a concerted effort of the people, with the support of local governments, can achieve this.

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3 Along the Edge of the Hill Country: The Texas Spring Line

James F. Petersen

> The underground water supplies of Texas are among its valued resources. In the long run they may prove to be the greatest underground resource, because the ground waters are perennially replenished by rainfall and seepage from streams on outcrops of the water-bearing formations, and if properly protected they should last indefinitely (Davis 1940, 17).

The dominant landform feature of Central Texas is the Balcones Escarpment, formed along a Miocene fault zone that produces a sharp topographic break between two major physiographic provinces of the United States: the Great Plains and the Gulf Coastal Plain (Fenneman 1931). The name "Balcones" dates to early Spanish explorers, who envisioned a resemblance between the escarpment and a balcony. The faulted nature of the Balcones Escarpment as a geological entity, however, was first recognized by geologist Robert T. Hill (1892). To the north and west of the escarpment lies the Texas Hill Country (Figure 3.1). Sometimes referred to as the Balcones Canyonlands (Riskind and Diamond 1986), this term is also quite appropriate, as, in many ways, the river valleys and canyons are more significant to the region than the hills. When in comes to relief, Hill

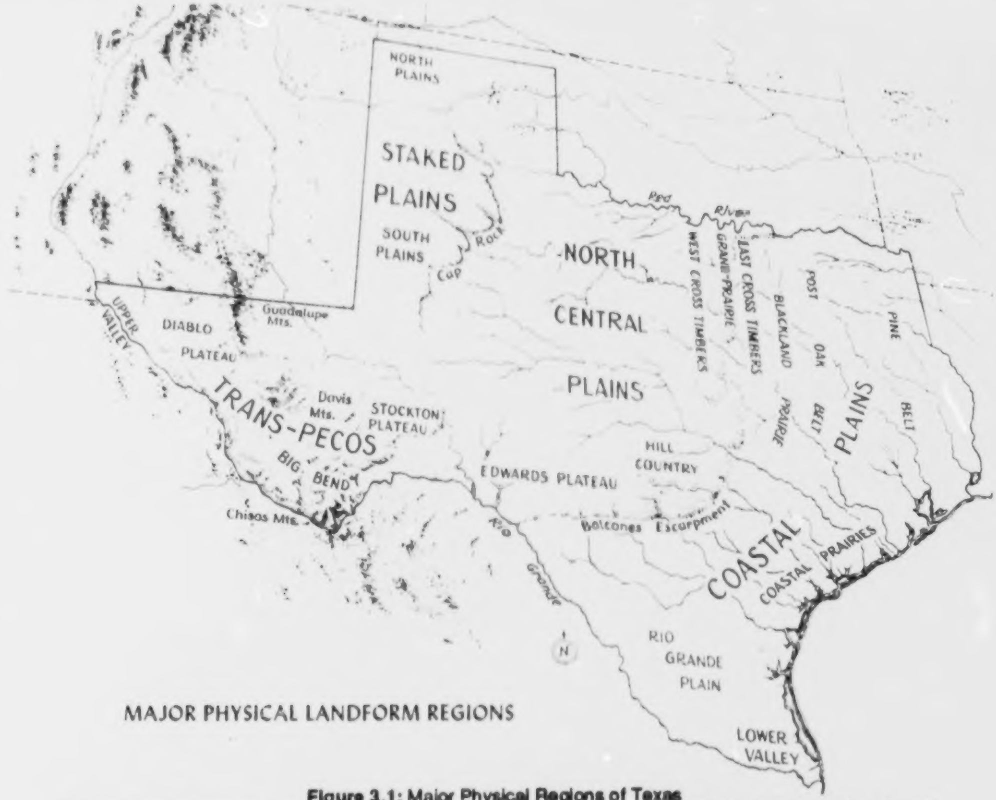

Figure 3.1: Major Physical Regions of Texas
This physiographic map shows the major physical divisions of Texas, and indicates the central location of the Hill Country. The perspective view accentuates the Balcones Escarpment as a topographic boundary between the Hill Country part of the Great Plains and the Gulf Coastal Plain.
Source: Reese, James V. and Lorrin Kennamer. 1978.

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Country people apparently tend to think positively. The Hill Country is dominated by Cretaceous limestones that are fairly resistant to erosion under the semi-arid central Texas climate.

As a boundary, the Balcones Escarpment provides more than just a topographic break. The edge of the escarpment has been a key transportation route, guiding travelers for hundreds and perhaps thousands of years, from Paleo-Indians to Spanish travelers on *El Camino Real*, to cattle drivers along the Chisholm Trail. Stagecoach routes were later replaced by the two-lane U.S. Highway 81, and then by the Interstate Highway 35 of today. Flawn (1964) regards the escarpment as a cultural-economic boundary of national importance, dividing the Old South (farms and cotton) and the West (ranches, cattle, sheep and goats). Woodruff (1992, 2-4), notes that the Balcones Escarpment "is generally recognized in this part of Texas as the beginning of the American West." Certainly, the Hill Country is widely regarded as one of the most scenic regions of the state. The scenery, rural ambiance, and recreational opportunities draw tourists to Central Texas from far and wide. Most Hill Country Texans, have a strongly positive spirit of *place*, and of *belonging to this place*. If there is a spatial equivalent of the temporal concept of *zeitgeist* (*site-geist*, perhaps?), this would be a fine place to apply that term.

Geologic Background

The geology of Central Texas and the Balcones Escarpment influences almost every element of the local environment: topography, vegetation, soils, climate, stream flows, and land use, as well as water availability and quality. All of these elements are linked to the local geologic history, lithology, and structure (Woodruff 1992).

During the Cretaceous Period (about 140 to 65 million years ago), an inland sea stretched across the midsection of North America. In what is now Central Texas, an extensive sequence of limestones formed in warm, shallow waters, deposited as limy muds on the sea floor. Reefs, lagoons, and mud flats rimmed shorelines, and dinosaurs roamed the small islands. Their tracks are abundantly preserved in the carbonate bedrock of the Hill Country. Lithologic, stratigraphic, and fossil evidence attest to the tropical climate and the environments of the time.

In the late Cretaceous, a few small volcanoes formed along the structural trend of today's escarpment. Pilot Knob, a hill just southeast of Austin, is a remnant of one of these volcanoes, as are similar features near Uvalde and Knippa, towns located to the west of San Antonio. Pilot Knob was a volcanic island, with a fringing reef, lagoon, and beaches of white limestone sand.

Uplift in the Balcones Fault Zone occurred during the Miocene along a complex system of sub parallel, branching (*en echelon*) normal faults. The general trend is a stepped lowering of fault blocks tilted down toward the coast. Structural offset of strata on opposite sides of the fault zone is about one thousand feet (three hundred meters), but the topographic expression of the escarpment is closer to 300 feet (ninety meters) or so, the difference being made up by the erosional removal of uplifted layers. As the Edwards Plateau rose, the rivers incised canyons. Fluvial dissection was particularly extensive in Central Texas and formed the hills that are the namesake of this area. Faulting along the Balcones is estimated to have ceased ten million years ago or so (Woodruff 1992), and the fault is not considered to present seismic hazards today. Despite a well-publicized earthquake near Alpine in West Texas in April 1995, earthquakes are one of the few natural hazards for which Texas has a low potential.

Cretaceous Carbonates in a Karst Landscape

In most Hill Country localities, the upper Cretaceous rocks have been removed by erosion to reveal caprocks and cliff-forming strata interbedded with softer limestones. Differential erosion and weathering on layers of resistant cliff-forming limestones and the softer marls form the distinctive white *stair-stepped hills* that are typical of this dissected portion of the Edwards Plateau (Figure 3.2).

In general, the limestone hills have a light gray to whitish color, producing a scenic landscape, dotted with a sparse cover of green junipers, oaks, and prickly-pear cactus, vegetation common in these range lands. The limestones are also fairly pure and may degrade by solution to form little or no soil, so that exposed bedrock is commonly found. Recent studies (Marsh and Marsh 1992)

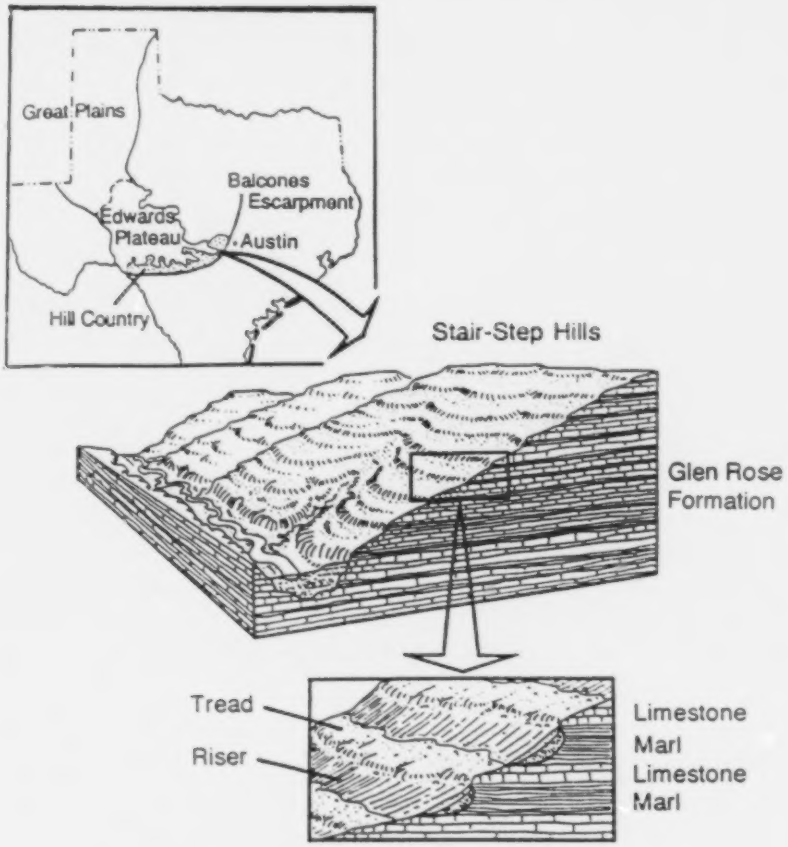

Figure 3.2: Stair-Step Hills of the Texas Hill Country
Source: Woodruff, C. M., Jr. 1992.

show that the marls (forming the risers between the steps) produce fair soils under normal conditions. Overgrazing, *cedar chopping* (cutting junipers to improve range), and other acts of human neglect or degradation have resulted in considerable soil erosion from a landscape that can ill afford to lose any of this scarce resource.

The best agricultural soils in the *limestone* areas of the Hill Country are floodplain deposits, silts and sands fluvially deposited in the valleys. Many Hill Country rivers (for example, the Blanco, Guadalupe, and Pedernales) flow in broad valleys with bluffs fairly distant from the stream channel of today. This configuration invites speculation concerning the size of the streams during the cooler times of the Pleistocene, although evidently, stream piracy has also played a role in the history of these rivers (Woodruff and Abbott 1986). Fredericksburg, a central Hill Country community, is in the valley of the Pedernales River, where uplift and erosion expose a sandstone that forms the basal Cretaceous rocks. This formation (the Hensel Sand) and the floodplain deposits along the creeks and rivers provide the sandy-loam soils that are especially suitable for agriculture. It was the river and the sandy soils that drew German immigrants to settle in the Fredericksburg area in the nineteenth century.

The Gulf Coastal Plain

From the edge of the Balcones Escarpment extending south and eastward is the Gulf Coastal Plain, a low-relief, low-elevation area that gently slopes toward the Gulf of Mexico. A broad belt of this region is characterized by Blackland Prairie, a zone of dark clayey soils developed on Upper

Cretaceous marls and chalks that are younger and generally less resistant than the Hill Country rocks. East of the escarpment, the rocks under the surface gently dip toward the Gulf. Low, rolling hills are typical of the inner edge of the Coastal Plain, which flattens toward the coast to grade almost imperceptibly with the Gulf of Mexico.

Some of the hills in the Coastal Plain are limestone fault blocks, offset in the zone of Balcones faulting but outcrop east of the topographic escarpment. A few prominent cuesta ridges are also are found in the Coastal Plain (Figure 3.3). The cuestas, slightly curved and parallel to the coast with the steeper side facing inland, are the topographic expression of sedimentary layers that dip gently coastward but are slightly more resistant than the rocks that form lowland the belts of the Coastal Plain. One of these Upper Cretaceous formations, the Austin Chalk, was quarried to construct the Alamo and other missions in San Antonio. The Austin Chalk is hard enough for building stone, yet soft enough to be worked easily.

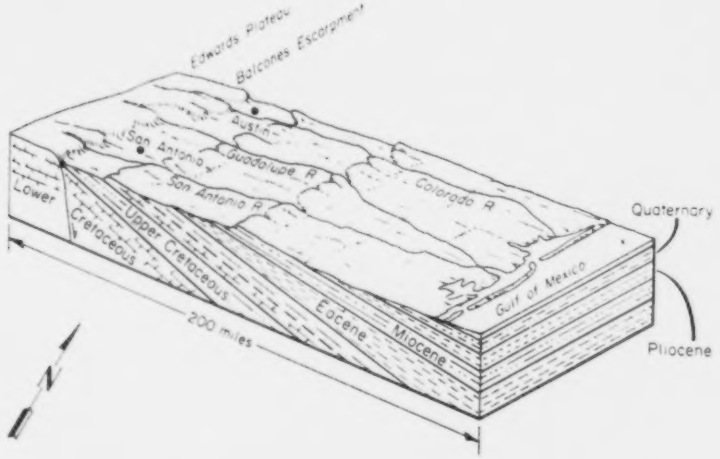

Figure 3.3: Block Diagram of the Texas Gulf Coastal Plain in Central Texas
Source: Hunt, Charles B. 1974.

The Balcones Escarpment: Texas's Spring Line

The most important of the Cretaceous rocks in the region, at least in terms of human existence is the Edwards Limestone. Uplift of the Edwards Limestone along with the Hill Country produced a gradient for ground water flow and resulted in solution of the carbonate rock. The lithologic nature of the Edwards Limestone makes it porous, and its already high permeability has been enhanced by solutional widening of numerous faults and fractures in the escarpment zone.

Solution has produced many limestone caverns along zones of weakness beneath the Edwards Plateau, and particularly along the Balcones Escarpment. Natural Bridge Caverns, near New Braunfels, is a truly beautiful, actively forming and highly decorated cavern that contains a wide variety of *speleothems* (depositional forms found in caves, i.e., stalactites, stalagmites, drip stone, flowstone, helictites that are growing from chemical precipitates). The escarpment also demarcates a migration path for Mexican free-tailed bats, and a colony estimated at twenty to thirty million bats dwells during the summer in Bracken Cave, north of San Antonio (Kingston 1993). The Nature Conservancy states that this is the highest concentration of mammals in the world and that the bats consume about one hundred and fifty tons of mosquitoes and insects every night. More bats live in this one cave than there are people in Texas.

The Balcones Escarpment has been compared to the Fall Line, the boundary between the Atlantic Coastal Plain and the Appalachian Piedmont in the eastern United States (Flawn 1964). Both physiographic boundaries separate hills from plains, and they both divide resistant older

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rocks on the interior side from softer, more recent sedimentary deposits, becoming increasingly younger toward the coast. A line of inland settlements marks the Fall Line, established there to take advantage of water power. An analogous settlement line exists also along the Balcones Escarpment, from Waco south and west to the Mexican border. Located along this curvilinear, northeast-to-southwest trending, structural feature are the cities and towns of Waco, Austin, San Marcos, New Braunfels, San Antonio, Brackettville, and Del Rio. All of these settlements are associated with ground-water springs, along the escarpment and what could be called *the Texas Spring Line* (Figure 3.4).

The edge of the Hill Country, the Balcones Fault Zone, is typically five to fifteen miles (eight to twenty-four kilometers) wide and forms a zone of ground-water recharge. The recharge zone is a relatively narrow belt where the Edwards Limestone outcrops at the surface, west and north of the escarpment, and its high permeability generates a considerable proportion of the ground water that feeds into the aquifer. A cross-section illustrates these relationships in the escarpment zone (Figure 3.5). The drainage areas upstream from the recharge zone form the *contributing zone*, where runoff is channeled into streams that flow over the *recharge zone*. *Influent* (standing higher

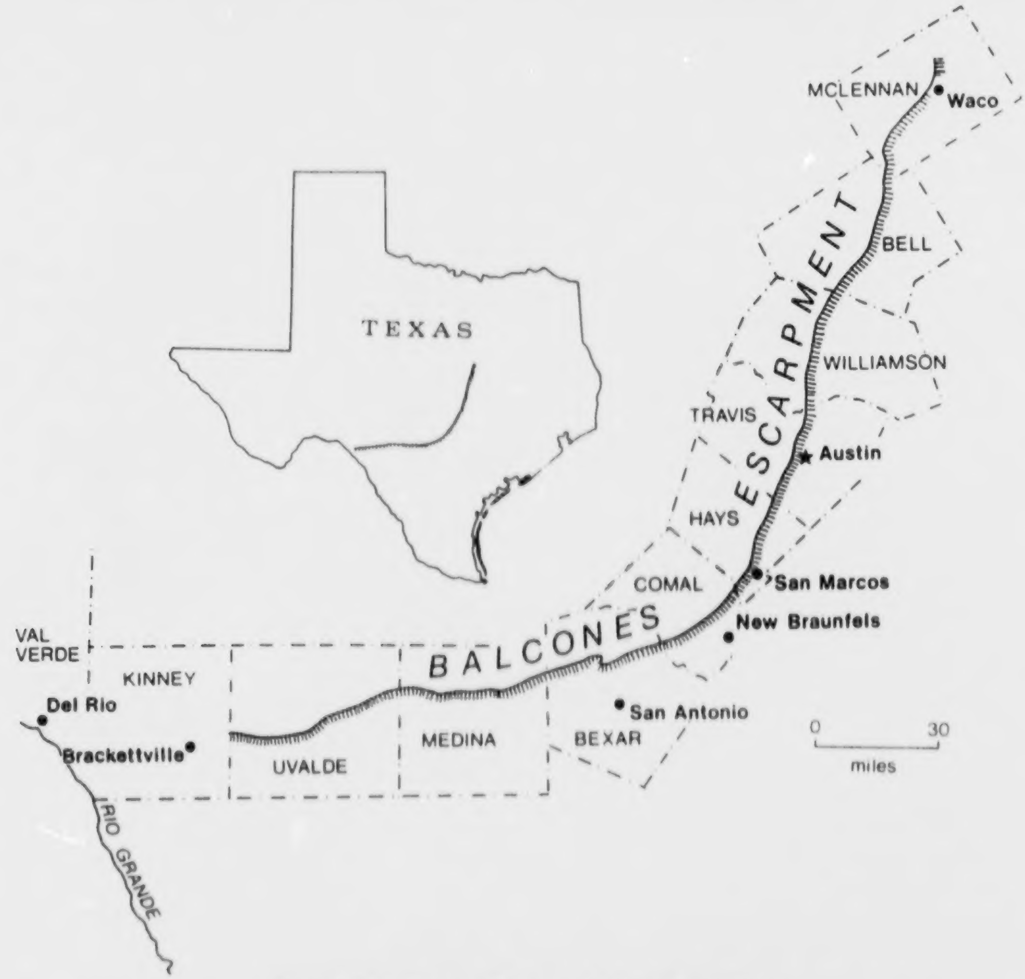

Figure 3.4: The Balcones Escarpment, Texas's Spring Line
Del Rio, Brackettville, San Antonio, New Braunfels, San Marcos, Austin, and Waco are the major towns and cities that developed near springs associated with the structural trend of the Balcones Escarpment.

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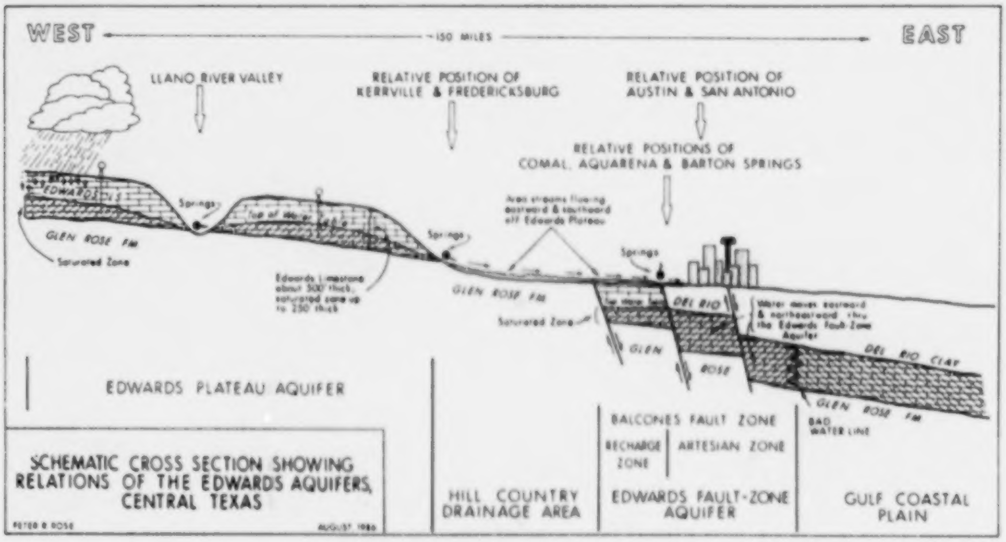
WEST
~150 MILES
EAST
LLANO RIVER VALLEY
RELATIVE POSITION OF KERRVILLE & FREDERICKSBURG
RELATIVE POSITION OF AUSTIN & SAN ANTONIO
RELATIVE POSITIONS OF COMAL, AQUARENA & BARTON SPRINGS
EDWARDS LS
Springs
Top of Water Table
GLEN ROSE FM
Saturated Zone
Edwards Limestone about 500' thick, saturated zone up to 250' thick
Springs
Area streams flowing eastward & southward off Edwards Plateau
GLEN ROSE FM
Saturated Zone
Springs
DEL RIO
Water moves eastward & northeastward thru the Edwards Fault-Zone Aquifer
GLEN
ROSE
DEL RIO CLAY
GLEN ROSE FM
BAD WATER LINE
EDWARDS PLATEAU AQUIFER
SCHEMATIC CROSS SECTION SHOWING RELATIONS OF THE EDWARDS AQUIFERS, CENTRAL TEXAS
PETER R ROSE
AUGUST 1986
HILL COUNTRY DRAINAGE AREA
BALCONES FAULT ZONE
RECHARGE ZONE
ARTESIAN ZONE
EDWARDS FAULT-ZONE AQUIFER
GULF COASTAL PLAIN

Figure 3.5: Cross Section of the Edwards Aquifer
Source: Rose, Peter R. 1986.

than the water table) *streams* traversing this zone feed high levels of ground-water recharge into the aquifer. Recharge is not only rapid, but it is also an ongoing, nearly-every-time-it-rains process. Water levels of this *karst* (limestone) aquifer change relatively rapidly, unlike that of most *clastic* (fragmented rock) aquifers. In many ways, the Edwards Aquifer behaves much like a surface reservoir, rising and falling with precipitation cycles.

The structural break along the Balcones Escarpment disrupts ground-water movement to produce numerous springs, some of which issue adequate artesian flow to provide the source for small rivers. A line of springs along a two-hundred-mile (320 kilometer) stretch of the escarpment, from north of Austin to Del Rio, was instrumental in the settlement of Texas probably since the beginnings of human occupancy in the region. Archaeological evidence from several Balcones spring sites indicates that Native Americans, perhaps as early as 11,000 years ago, were drawn to the waters. These springs (San Felipe, San Pedro, San Antonio, Comal, San Marcos, Barton, and others) have been extremely important oases in a part of Texas that is subject to extended droughts as well as hot, dry, and lengthy summers. Ferdinand Roemer (1849), a nineteenth-century traveler in the area, described the artesian springs as sites of great beauty, with natural fountains of water. Little wonder that early inhabitants and explorers, as well as the people today, have all been drawn to the springs. The spring-fed rivers, such as the Comal and the San Marcos, as well as most streams that drain the limestone parts of the Hill Country (including the Guadalupe and Blanco rivers) are characteristically crystal clear, being relatively free of suspended load. The Comal and the San Marcos, rivers that are ground-water-fed from their source at springs along the escarpment, also tend to have the same temperature year-round (about 70° F, or 21° C). Comal Spring in New Braunfels is the largest spring in the Southwest, flowing at an average of 320 cubic feet per second (nine cubic meters per second) or 210 million gallons (795 million liters) per day (Brune 1975). San Marcos Springs issues roughly half that output to the San Marcos River.

The water resources of the Edwards Aquifer—a permeable, porous, sponge-like, and cavernous limestone formation—are a crucial natural resource for Central Texas. The Edwards Aquifer supplies much of the drinking water for towns along the Balcones Escarpment (San Antonio, New Braunfels, and San Marcos, as well as suburban areas south of Austin). Because of uplift along the Balcones, water drains downward and generally eastward, to form a line of artesian (free flow-

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ing) springs along the escarpment. Unfortunately, the flow of ground water is much more complex than this general trend, and it is difficult to track. Caverns and sink features provide additional avenues for rapid, multidirectional ground-water movement. The Edwards has been referred to as an *underground river* (uncharted though it is). This classification has not been proposed lightly or naively, although it was in an unsuccessful attempt to categorize the ground water of the Edwards Aquifer under the same (and stricter) statutes that govern and act to protect surface waters.

Undoubtedly the contributing zone, the recharge zone, the Edwards Aquifer, the springs, and the rivers will require careful management to protect and enhance the quantity and quality of the ground water they supply. Several problems facing the region, include increasing urbanization and suburbanization of the recharge zone, which will lead to increased numbers of septic tanks over a zone of limestone so porous that filtering of influent recharge may range from a reasonable amount to nil. There is also worry that one of the many pipelines (or tanker trucks or train cars) that carry hazardous fluids will suffer a catastrophic leak and damage the purity and potability of ground water in the Edwards Aquifer.

The Edwards Limestone is the *sole* source for potable water in the city of San Antonio, the largest city in the U.S. that uses ground water exclusively to meet its needs, and the Edwards Aquifer supplies water to about one and a half million people along the escarpment. The levels of water in the aquifer and the flow of the springs are each highly responsive to annual fluctuations in precipitation. In 1973, Comal Springs in New Braunfels produced a record flow of 534 cubic feet per second (fifteen cubic meters per second), yet in 1957, after a lengthy period of drought, the springs dried up for the first time in recorded history (Brune 1975). In the 1980s, Comal Springs again failed to flow after a period of drought, shutting off the source of the Comal River.

Texas ground-water laws complicate the situation. These permit virtually unlimited use of the water underneath the property of a private landowner. A catfish farm, opened in the early 1990s, pumped forty-six million gallons (174 million liters) of water a day from the aquifer, until authorities halted its use. They based closing the catfish operation not on ground-water usage, but on test results on the quality of the effluent farm ponds discharged into a surface river. One fortunate aspect of this episode was that it focused attention on the inadequacies and inappropriateness of old laws written to address the needs of an earlier and smaller, less urbanized population.

"It's Floodin' Down in Texas"

Texas Hill Country residents, perhaps typical of those who live in places known for their natural beauty, pay a price in terms of natural hazards. The flash-flood potential here is among the worst in the nation, and perhaps the world (Caran and Baker 1986), lending veracity to the line "It's flooding' down in Texas," from a song by blues musician Stevie Ray Vaughn. This difficulty with flooding derives from a unique combination of climatological, topographic, and geologic factors, each of which deserve some examination. Victor Baker (1975) effectively determined and synthesized these in an important paper.

Climatological Factors Affecting Flooding

The Hill Country, especially during spring and fall, is subjected to the clash of air masses from the tropics and the continent. Tropical air masses from the Gulf of Mexico easily intrude the low Coastal Plain and run into either the Balcones Escarpment or the Edwards Plateau that provide orographic enhancement, or into a polar air mass (locally called "northers" or "blue northers") rolling down the Great Plains. To the north, the Great Plains offer no barrier to stop continental-polar air, although fortunately, these air masses are moderated as they flow toward Texas. It might seem that the three-hundred-foot-high (ninety-two meter) Balcones Escarpment is not high enough for orographic enhancement of precipitation, but typically, the air involved is humid and relatively unstable before encountering the topographic break. Because of the mutual reinforcement of orographic and air-mass climatology, Central Texas holds a few precipitation records, and many near-misses. There is ample evidence that orographic influences operate along the escarpment. Onshore movement of extremely moisture-laden air associated with tropical depressions flowing onshore from the Gulf of Mexico further reinforces this effect.

In this region, extremely intense, short-term (lasting twelve hours or less) rainfall events have occurred. Thrall, Texas, located not far from Austin, received thirty-seven inches (ninety-three centimeters) in eighteen hours in 1921, and in 1935, D'Hanis (west of San Antonio) received twenty-two inches (fifty-six centimeters) in only two hours and forty-five minutes. Both of these events are purported to be world records of accumulation for the time periods indicated (Caran and Baker 1986).

Topographic-Environmental Factors

Intense precipitation falling in a short time can produce particularly high rates of runoff, with resultant flooding. The amount of *meteoric* (atmospheric) water that infiltrates the ground reduces runoff and diminishes flood potential. Several factors favor increased seepage into the ground, including gentle ground slopes, heavy vegetative cover, and deep soils. The Hill Country has the opposite of all three factors: steep slopes, sparse vegetative cover, and thin soils or often bare rock. These conditions, exacerbated by overgrazing in rural areas and increasing impermeable cover in urban areas, contribute to extremely rapid runoff into streams and intensify flooding.

Factors Involving the Streams

Finally, the relatively unusual nature of karst stream channels in Central Texas also acts to make flooding worse in the Hill Country. A stream can adjust to increased flow in several ways. A flooding stream will increase its velocity of flow, deepen its channel, or widen its channel (or some combination of these factors) to accommodate the increased discharge. All of these factors help a stream handle increased flow for a given moment. Unfortunately, in some ways, Texas Hill Country river channels behave more like canals than streams.

Most normal streams have beds of coarse alluvium that floods will scour out and transport during floods. Transporting the bed load tends to slow down a stream, and excavating the bed makes the channel larger (deeper) and minimizes the potential for water spilling over the banks, which is how we define a flood. Because limestone dissolves in water, streams that drain limestone areas of the Hill Country seldom have much of a bed load, so the more water they receive, the faster they tend to flow. The river bed is often solid limestone, which the river cannot scour out to make a deeper channel. With these factors eliminated, a stream behaves in the only manner that it can: it flows faster, and goes over its banks to handle the increased flow. Furthermore, many Hill Country canyons are narrow, which only serve to accelerate the flow. A block diagram from Baker (1975) clearly illustrates the characteristics of Hill Country topography that tend to increase the potential and intensity of flash flooding (Figure 3.6).

Hill Country floodwaters tend to rise rapidly and fall nearly as quickly. Many people have been trapped and drowned by flash floods. Rural and some urban and suburban areas still have *low water crossings*, dips in roads that cross normally dry creeks. A particular hazard results when motorists try to drive over flooded parts of the road, sometimes through rushing torrents. Making the wrong decision about what constitutes low water can be a fatal mistake that happens all too often. "No water crossings" might be a better phrase to describe these swales.

In response to the record precipitation intensities received in Texas, streams and rivers can yield astonishing flow discharges, particularly when the size of the basin producing the flow is considered. Data gathered from several sources by Caran and Baker (1986), shown in graph form, illustrate the immensity of flows during times of peak stream-flood for selected Texas storm events, compared to the average discharge at the mouth of the Mississippi-Missouri River system, and the Nile River at its delta (Figure 3.7). The Nile makes a useful, unit round number for comparison, because its mean discharge is about a hundred thousand cubic feet (three thousand cubic meters) per second (for example, the Mississippi is six times larger, and so on). It is clear that flooding Texas rivers and *dry creeks* can generate flood-peak discharge amounts that equal or exceed the average discharge of these two rivers, which are among the largest in the world.

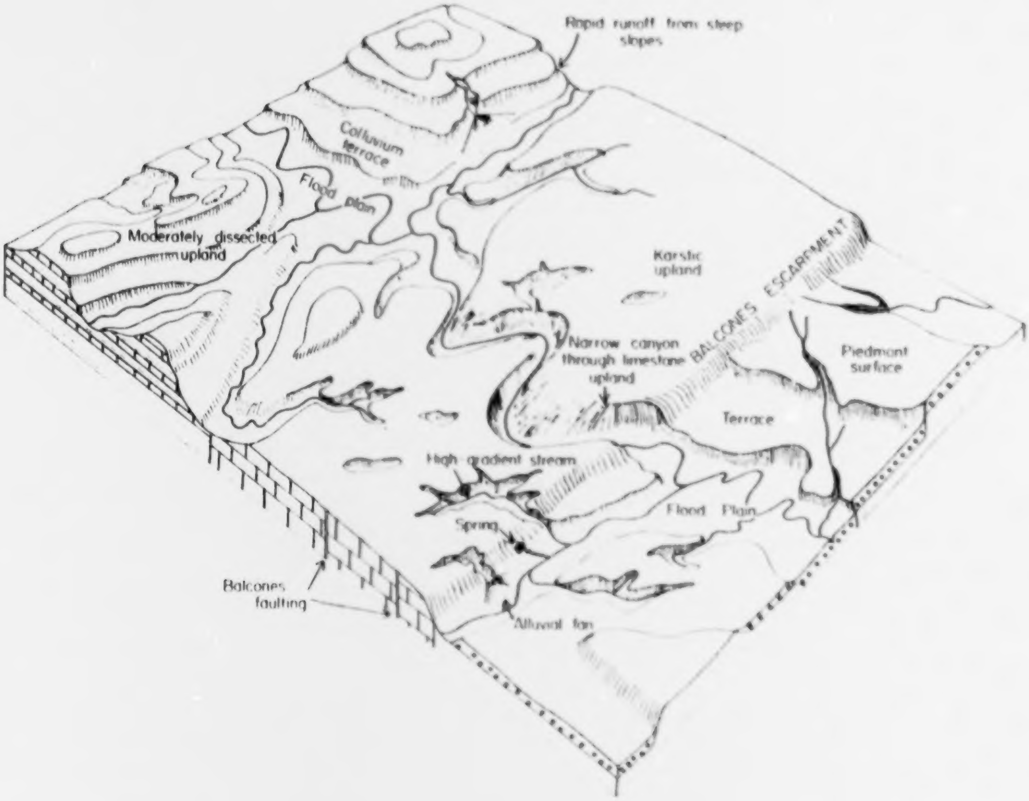

Figure 3.6: Geomorphological Features That Affect Hill Country Floods
Source: Baker, Victor R. 1975.

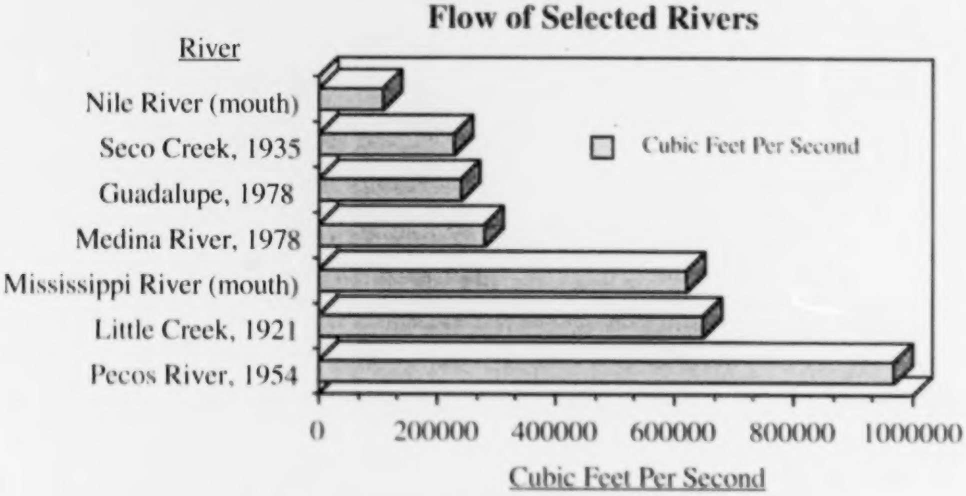

Figure 3.7: Comparisons of Peak Flood Discharges for Selected Rivers
Source: Caran, S. Christopher, and Victor Baker. 1986.

Conclusion

Water resources and the environments they provide are vital to life and the quality of life along the Spring Line in Central Texas. They *are* the reason why people for thousands of years have come to this environment and have learned to appreciate it. Population pressure on a limited but precious resource may eventually cause the springs, and therefore the ground-water-fed rivers, to dry up someday. We cannot neglect wise water conservation and management measures.

Water will play a larger role in the future of Texas than oil has in its past. Whether Texas is receiving too much water in the form of floods, or not enough water as a result of drought or human use exceeding the available resource, water is a critical natural resource to the state. Mitigation and understanding of flood hazards and flood danger are critical to Hill Country residents. The paradox of water in Central Texas is one of having either too much or not enough, and residents must work to avoid both of these scenarios while preparing themselves for either.

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Means and Extremes: The Weather and Climate of South-Central Texas

4

Richard A. Earl
Troy Kimmel

The weather and climate of south-central Texas are strongly influenced by its subtropical location at the southern end of what has been called the "North American Weather Corridor." Rather than having "intermediate" or transitional weather, the region tends to experience the extremes of interior North America as well of those of the tropical Gulf of Mexico. Hurricanes, tornadoes, Arctic blizzards, torrential downpours, flash floods, long periods of drought, and 38°+C (100°+F) temperatures are all possible in the *normal* weather cycle of the region. Climatic statistics such as mean values of monthly temperature and precipitation can be misleading, as they portray winters as cool and summers as warm, with moderate precipitation over the year. We will present a brief overview of the major characteristics, the processes and controls, and major problems and hazards of the weather and climate of south-central Texas (Fig. 4.1).

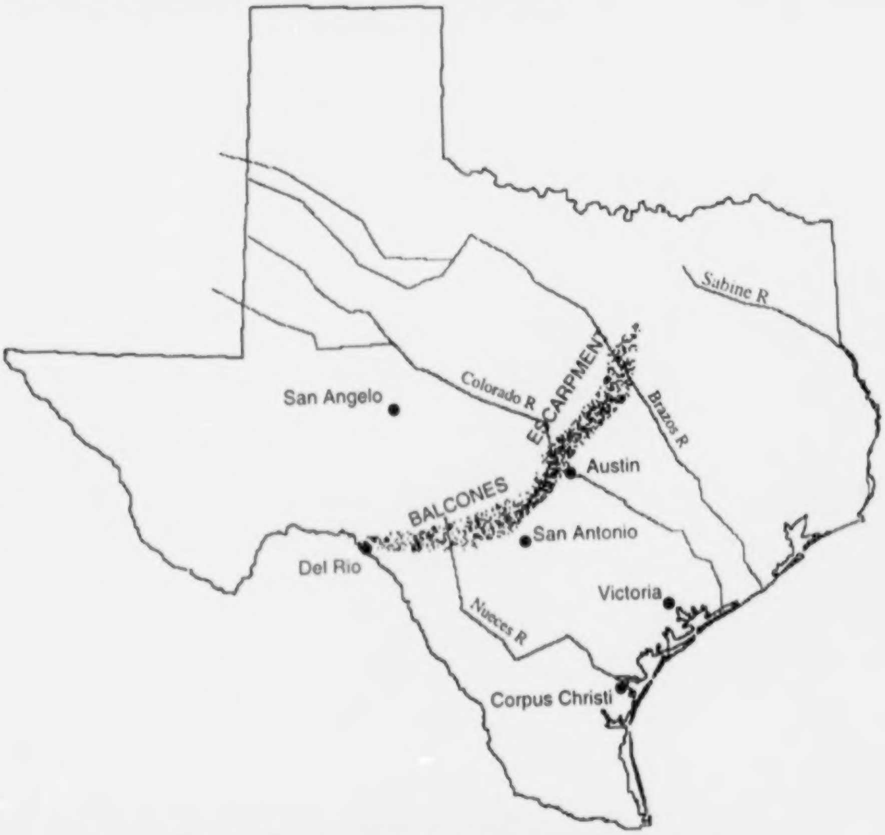

Figure 4.1: The South-Central Texas Region Showing Major Physical Features and First-Order Weather Stations

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Mountain barriers make Texas a weather battleground. The North American Cordillera blocks most Pacific moisture but does not block storms and air masses from the west. The Appalachians block heavy, cold air from going eastward. Air masses are channeled north or south between these mountain ranges in a corridor that extends from the Arctic Ocean to the Gulf of Mexico, nearly 40° of latitude (4000 km.). A popular saying is that there is "nothing higher than a few barbed wire fences" to hinder the encounter of frigid Arctic (A) and continental polar (cP) air masses with steamy maritime tropical (mT) air from the Gulf of Mexico. Maritime tropical air dominates the weather of south-central Texas in June, July, and August. During the rest of the year, air mass types greatly influence weather as the region experiences incursions of modified maritime polar (mP), continental tropical (cT), continental polar (cP) and Arctic (A) air masses (Fig. 4.2). Climographs for central and south Texas stations demonstrate that from October through May, temperatures are more variable and larger daily temperature ranges occur than in the three summer months because air masses from October through May are generally drier, which permit greater night time cooling (Fig. 4.3).

Climate Controls and Characteristics

A dominant climatic control for a given location is its position within the global atmospheric circulation that forms the distinct *belts* of the Earth's wind system. Driven by the seasonal migration of

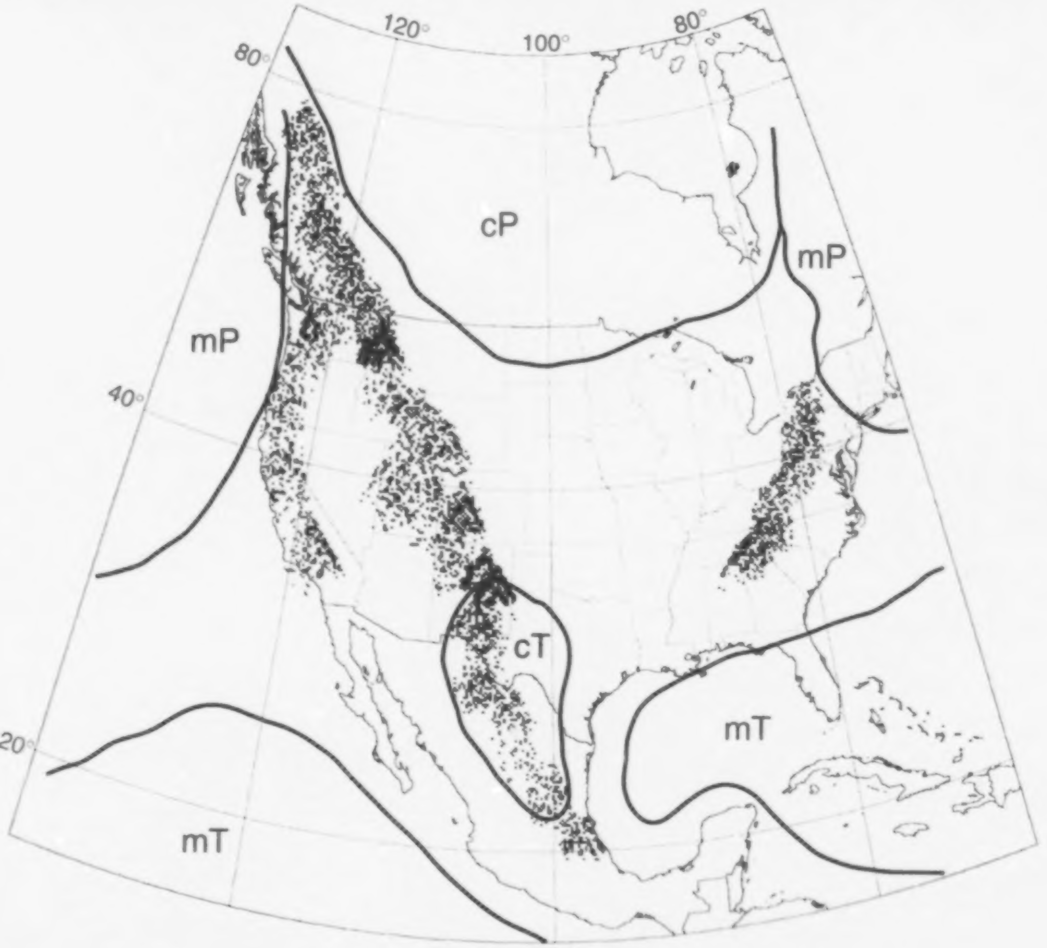

Figure 4.2: Major Physical Barriers and Air Mass Source Regions Affecting the Weather and Climate of South-Central Texas

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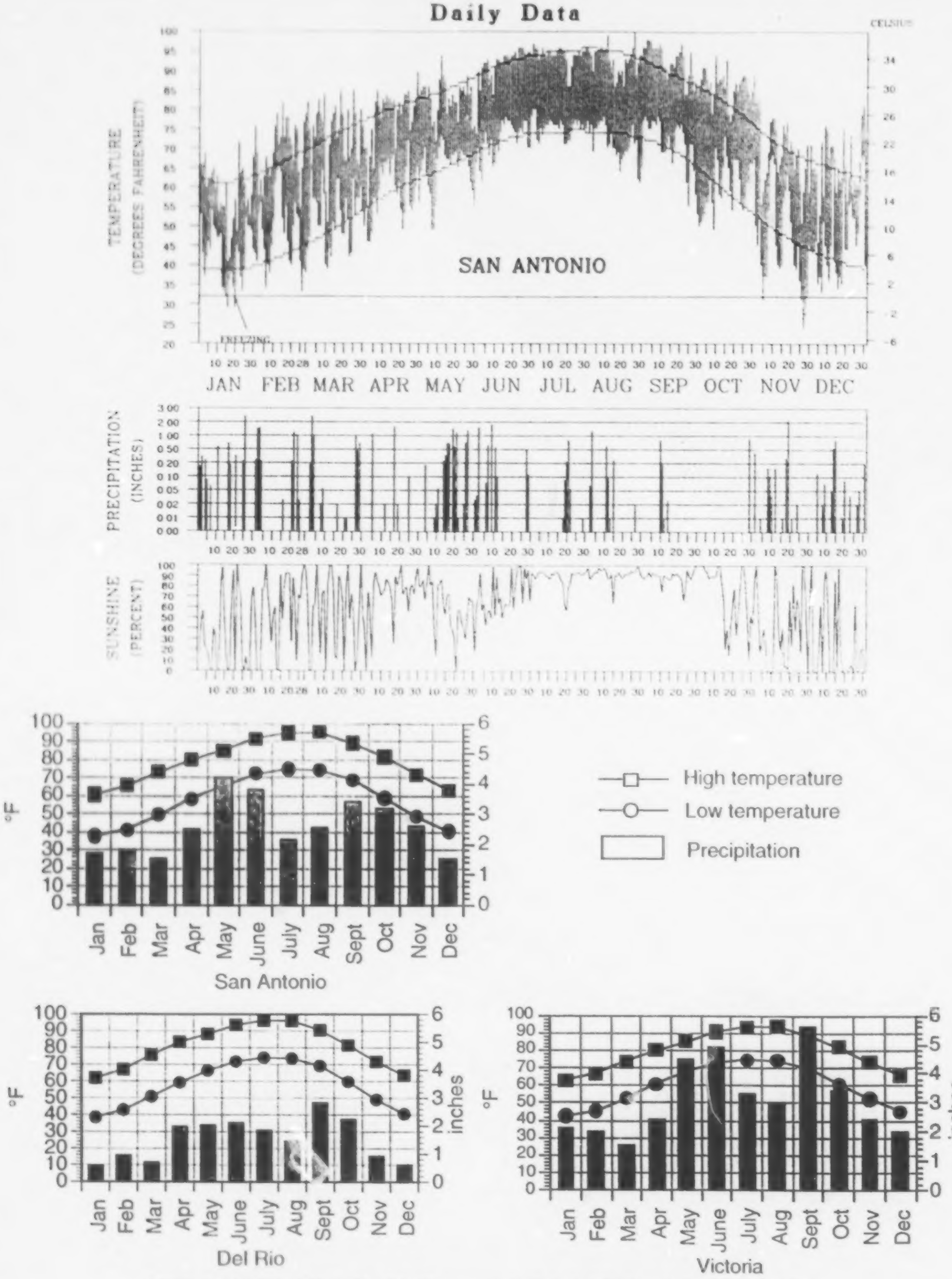

Figure 4.3: Daily and Mean Monthly Climograms for Selected Stations in South-Central Texas
Sources: U.S. National Oceanic and Atmospheric Administration. 1993, 1994.

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the zone of maximum solar heating, the wind belts migrate north and south. A lag of approximately a month occurs between the farthest northerly or southerly locations of the direct rays of the sun and the maximum displacement of the wind belts. This lag results from the time that it takes earth materials, especially water, to warm or cool in response to seasonal changes in sun angle and resultant solar input.

Winter circulation affecting Texas is farthest south around February 1 and summer circulation is farthest north around August 1. As shown in Figure 4.4, Texas is located just south of the winter polar front and in the core circulation of the westerlies. In the summer, Texas lies between the Pacific and Atlantic subtropical highs and within the northern fringes of the tropical trade winds.

Without major physical barriers or great elevation changes, climate differences between central and south Texas tend to be gradual. Meteorological data from first- order weather stations near the edges of the region reflect this gradational climate characteristic (Table 4.1). Annual precipitation totals generally increase from west to east—on average from about 25 mm (1 in.) for every 15 to 30 kilometers (10 to 20 mi.) in an eastward direction. Proximity to the Gulf of Mexico

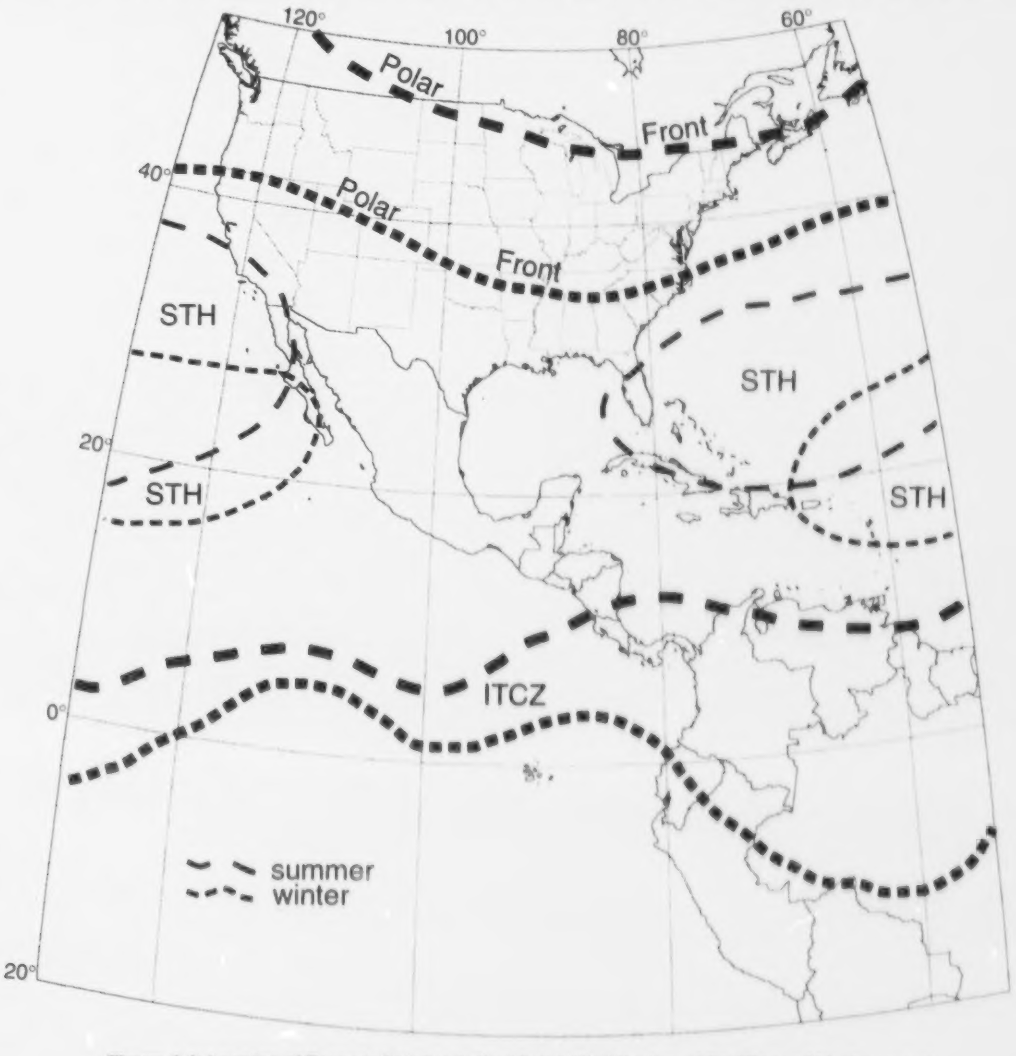

Figure 4.4: Location of Texas in Relation to the Global Wind System at the Times of Northernmost and Southernmost Displacement of the Intertropical Convergence Zone

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	Austin	Corpus Christi	Del Rio	San Angelo	San Antonio	Victoria
January temp. °F.						
mean high	58.9	65.9	61.9	56.8	60.8	62.8
mean low	38.6	45.3	38.5	30.6	37.9	42.4
record high	90	91	89	90	89	88
record low	-2	14	15	5	0	14
Precip. (in)						
mean	1.71	1.71	0.56	0.80	1.71	2.16
record high	9.21	10.78	1.92	3.65	8.5	27.76
record low	0.04	0.03	0.00	0.00	0.04	0.02
July temp. °F.						
mean high	95.0	93.3	96.2	96.2	95.0	93.5
mean low	73.9	74.8	74.1	68.4	75.0	74.6
record high	109	104	109	109	106	104
record low	64	64	64	54	62	62
Precip. (in)						
mean	2.04	2.39	1.85	1.06	2.16	3.34
record high	10.54	11.92	13.18	7.21	8.29	13.59
record low	0.00	0.00	0.04	0.00	0.00	0.07
Annual temp. (°F)						
record high	109	104	112	111	108	107
record low	-2	13	10	-4	0	9
Precip. (in)						
mean	31.88	30.13	18.24	20.45	30.98	37.41
record high	64.68	48.16	37.75	42.12	52.28	56.72
record low	11.42	5.38	4.34	7.41	10.11	17.95

Table 4.1: Temperature and Precipitation Summary for Austin, Corpus Christi, Del Rio, San Angelo, San Antonio, and Victoria
Source: U.S. National Oceanic and Atmospheric Administration. 1994.

and higher humidity cause coastal locations to have smaller daytime and seasonal temperature variations. Accordingly, interior locations have hotter summer days and colder winter nights, but have less sultry summer nights and fewer cloudy winter days. There is a significant temperature break with lower temperatures, particularly overnight lows, in the Edwards Plateau and toward the west, that can be attributed to the higher elevations and drier air. As would be expected, temperatures, especially during the low-sun months, are higher toward the south. This phenomenon is most noticeable toward the west (Larkin and Bomar 1983). San Angelo, approximately 160 km. (100 mi.) north of Del Rio, is 3.6°C (6.5°F) cooler in January whereas Corpus Christi and Victoria, approximately the same north-south distance apart, have January temperatures that are only 1.4°C (2.5°F) different (U.S. National Oceanographic and Atmospheric Administration 1994).

Winter

Winter weather is controlled by strong westerly flow through which cyclonic storms form, develop, and dissipate. The location of Texas in the *disturbed westerlies* almost by definition cannot be described by the seasonal averages other than to say that it is variable. Winter weather is determined by the type of circulation within the westerlies that controls the air masses over the region. If the dynamic influences of the westerlies could be removed, the *typical* January day would have a high temperature of 15°C (60°F) and an overnight low of 5°C (40°F). In reality, relatively few of these representative days occur during the October-May period because of the dynamic circula-

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tion affecting the region. If we could consider any climatic factor *normal*, it would be the weather associated with the passage of a Pacific cold front across the region. Before the front passes, the weather is mild and humid; the passage of the front can be associated with bands of rain, and sometimes with vigorous thunderstorms. Cold dry air behind the front warms slowly and is replaced by more humid air from the Gulf of Mexico. Variations on this theme occur when cold fronts stall and develop a stationary front that may result in days of cool rainy weather. After the passage of a mild cold front, central Texas often experiences "chamber of commerce weather" with warm dry days and cool clear nights. Not so eagerly publicized are the "Blue Northers" that follow Arctic cold fronts southward to bring day-time temperatures below freezing, which are made more unbearable by the addition of significant wind-chill.

Summer

Summer weather is more predictable: hot and humid days with occasional, but often intense, thunderstorms. Maritime tropical air is pumped in from the Gulf of Mexico by the combined effect of the clockwise flow out of the Bermuda (subtropical) High, the easterly trade winds, and summer monsoonal circulation into North America. Most precipitation events are produced by air mass thunderstorms but these are often triggered or enhanced by a lifting mechanism such as the passage of a summer trough or cut-off low through the westerlies to the north or by a comparable *easterly wave* in the trade winds.

Climate Hazards and Problems

In Texas, any month can experience severe weather. Storms in the westerlies can develop in a number of troublesome ways. A high-pressure ridge in the jet stream over the Rocky Mountains can channel frigid Arctic and continental polar air into central and even south Texas. When this air displaces humid air from the Gulf, cold gray weather can persist for days. If the flow of cold air is persistent and if enough Gulf air flows onshore, the warm, humid air rises over a wedge of frigid polar or Arctic air, and the result is freezing rain and an ice storm (Bomar 1983).

Another gray sky producer occurs when a low pressure system over northwestern Mexico draws in high and middle altitude moisture from the Pacific and high pressure over Florida pumps in low level air from the Gulf of Mexico. This blocking pattern produces a stationary front over the region that can cause persistent light to moderate rains and eventually can produce significant flooding as occurred in December 1991 and January 1992.

Some of the region's most violent weather occurs in the spring when vigorous Pacific cold fronts roar across central Texas. For most of the region, April and May are the wettest months and many of the floods of record have been produced by these storms. Large north-to-south temperature contrasts energize the fronts that displace warm mT (maritime tropical) air on ground surfaces warmed from the more direct sunlight associated with the northward progression of the sub-solar point. Add a little Arctic air aloft, and conditions are optimal for extremely vigorous convectional uplift. The passage of these fronts is often associated with damaging hail, lightning, tornadoes, down-burst winds, and torrential rains. Flooding is exacerbated by squall lines that follow the flood crest from the headwaters downstream in the west-to-east flowing streams of central Texas such as the Colorado, Guadalupe, Blanco, Pedernales, and Llano Rivers.

Severe summer weather is produced by air mass thunderstorms and tropical cyclones. Summer conditions are optimal for air mass thunderstorms: hot surface temperatures and mT air with dew point temperatures above 20°C (68°F). The location of Texas adjacent to the Gulf of Mexico places it in one of the world's most active regions for tropical cyclones. The deadliest natural disaster in our country's history occurred in 1900 when a hurricane with a storm surge of 8 meters (25 ft.) swept over Galveston killing 8,000 people (U.S. National Oceanic and Atmospheric Administration 1977; Costa and Baker 1981; Tait 1995). The low-lying and flat Gulf Coastal Plain places an immense area at risk from both stream flooding and storm surge rise in sea level. In many locations on the Gulf Coast, the 10 m (33 ft.) contour is located more than 30 kilometers (19 mi.) inland.

Extreme flooding is also produced along the Balcones Escarpment, the first terrain barrier that these storms encounter on their journey inland from the coast. The escarpment is only about 100 meters (300 ft.) high, but it can produce enough orographic uplift to enhance convective precipitation because the air from the Gulf is so moist and unstable. These conditions have produced some of the world's greatest storm precipitation totals (Fig. 4.5). Flooding produced by these storms is exacerbated by the terrain, soils, and land use history. More than a century and a half of overgrazing has denuded much of the already thin Hill Country soils so that much of the region is nearly bare limestone bedrock. Furthermore, many soils have high clay content that reduces infiltration. Most of the region is classified as Hydrologic Group C or D signifying high runoff coefficients (Batte 1984). Even streams with an average flow of less than 3 cubic meters/second (100 cubic feet/second) have recorded highly abnormal flood discharges. The September 1952 flood of record occurred on the Pedernales River at Johnson City with a drainage area of 2350 sq. km. (900 sq. mi.) is 12,500 cubic meters/second (441,000 cubic feet/second) (Patterson 1965; U.S. Geological Survey, 1993).

Precipitation variability

Large year-to-year variations in annual and seasonal precipitation are common. Dry winters result from an upper atmosphere ridge over the central United States that diverts frontal storms farther north. This pattern in summer will produce drier and hotter weather than normal. Summer drought and heat waves will also result when the Bermuda High expands farther west than usual and places a cap of warm subsiding air over the region that hinders thunderstorm development (Bomar 1983). For Austin, this pattern produced 61 consecutive rainless days and 20 days with temperatures above 37°C (99°F) during the summer of 1993 (U.S. National Oceanic and Atmospheric Administration 1993a, 1993b).

Wet winters result when a low-pressure trough over the West steers storms and mid-level moisture from the southwest and draws in moisture from the Gulf of Mexico. Theoretically, such a pattern should result from a *warm water-El Niño* off California but statistical analyses have shown that El Niño's perceived effects are greater than the actual precipitation data would justify (Earl and Harrington 1994).

Effects of climatic variability

Although we may not fully understand the driving mechanisms for climatic variability and change, variability is an inherent component as much as the mean or *average* values in terms of characterizing the region's climate. This variability forces water and energy utilities to accommodate peak demands that are often difficult, and expensive, to provide. Persistent Blue Norther patterns cause natural gas consumption to skyrocket. The extended summer, high-pressure drought season dramatically increases peak electrical demand for air conditioning and can triple daily water demand over the winter values. The annual positions of the BS/Cfa (semi-arid/sub-humid) climate boundaries demonstrate the precipitation variability (Fig. 4.6). The response of regional water supplies to this variability is critical to central Texas. Recharge to the San Antonio section of the Edwards Aquifer, the sole source of water for more than 1 million residents in the greater San Antonio metropolitan area, has varied from a low of 54 cubic hectometers (44,000 acre feet) in 1956 to more than 3000 cubic hectometers (2,400,000 acre feet) in 1992. This fifty-fold difference in ground water recharge was produced by precipitation that ranged from 40 to 180 percent of the long term average and suggests that usable water supply varies at approximately the cube power of the precipitation variability (U.S. Geological Survey 1991; Edwards Underground Water District 1993).

Air Quality

Compared to Houston, El Paso, Dallas-Fort Worth, and other large metropolitan areas, the region has good air quality. Both Austin and San Antonio meet federal air quality standards, but occasionally have high ozone levels during strong, stagnant, anticyclonic conditions during the summer. Both cities have programs to reduce volatile organics from stationary sources and have public relations campaigns and free bus service on *ozone alert* days to reduce automobile emissions.

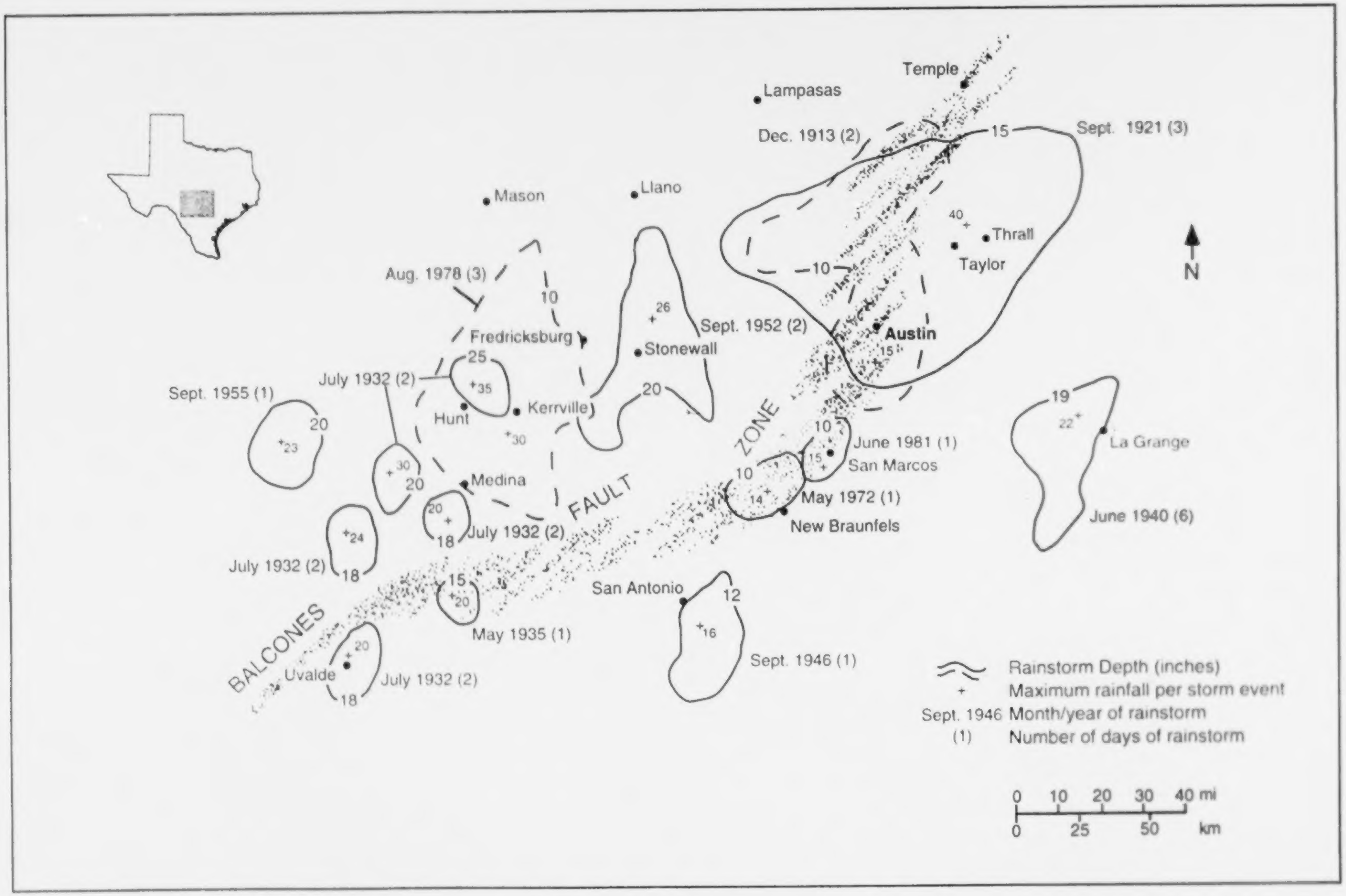

Figure 4.5: Locations, Extents, and Dates of Extreme Precipitation Events in South-Central Texas

Source: Adapted from Slade, Raymond M. 1986.

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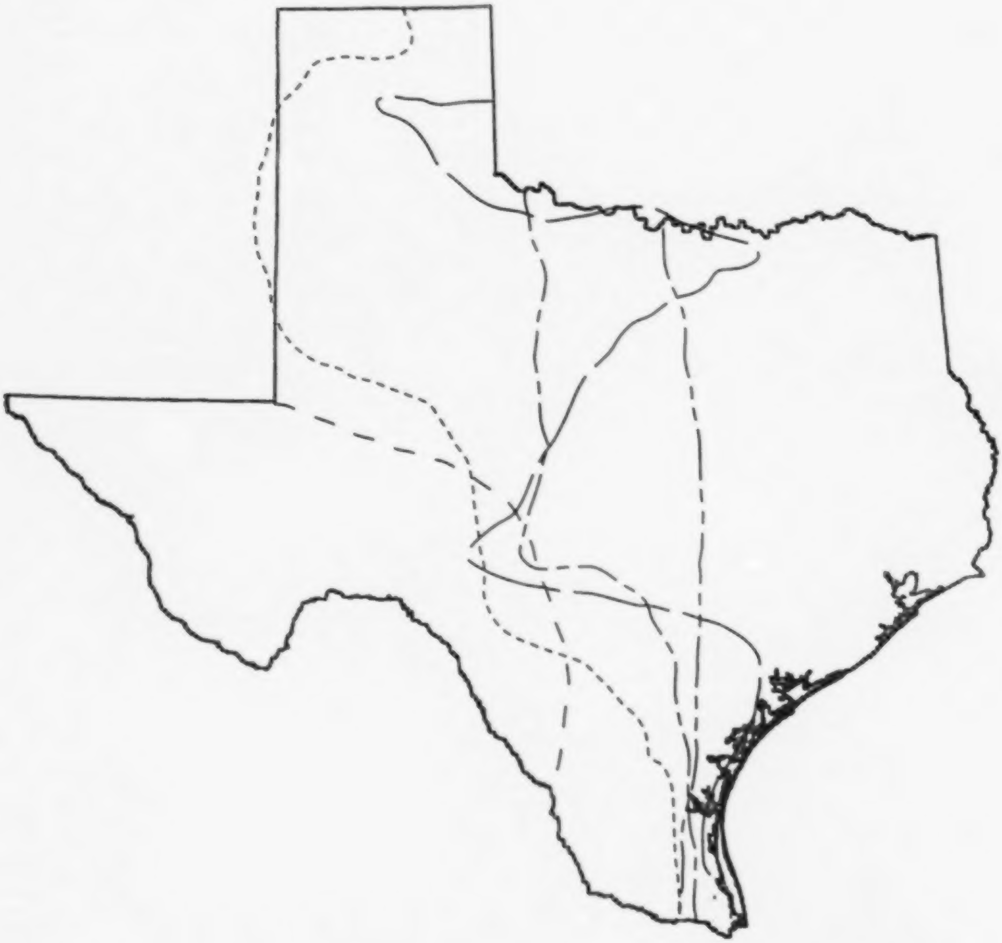

Figure 4.8: Annual Positions of the Semi-arid/Sub-humid (BS/Cfa) Boundary in Texas over Five Years
Source: Trewartha, Glenn T. and Lyle H. Horn. 1980.

Allergies constitute another major air quality issue. At any time during the year a significant number of people suffer from some airborne allergen. Perhaps the most notorious is "cedar fever," produced by Ashe juniper (*Juniperus ashei*) pollen in December and January. Overgrazing and the reduction of natural grass fires has produced a massive increase of this aggressive tree/shrub in the former oak parklands of the Texas Hill Country (Scifres 1980; McMahan, *et al.*, 1984).

Perhaps the best term to describe the weather and climate of south central Texas is dynamic. The region's location along the North American Weather Corridor facilitates the vigorous exchange of cold polar air, and warm, moist maritime tropical air. Departures from the *normal* patterns within the subtropics and westerlies will produce abnormally wet or dry conditions. This inherently unstable condition produces weather that frequently is more *extreme* than the *mean values* for that time of the year would indicate.

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Site and Situation: A Historical Geography of San Antonio

5

Jeffrey B. Roet

Site, or *absolute location,* describes a fixed position on a grid system, such as latitude and longitude. We can also define a city's physical-geographic features as site characteristics, because we can *broadly* consider environmental aspects of location, such as topography and climate, as static factors. San Antonio's three major site characteristics—its water resources, topography, and ecotone—all have played on important role in the city's historical geography.

We can define situation as the dynamic relationships between places, in this case, between San Antonio and other cities and regions. Changes in transportation, trade, and the political, financial, or other linkages that connect places can influence situation or relative location. Events taking place outside the city (such as growth of other competing cities) or changes within the urban region (such as a rise or fall in the fortunes of its economic situation) can alter a city's situation. San Antonio, since its establishment as a Spanish mission in 1718, has gone through eight eras of historical geography, each based on a change in relative location.

San Antonio's Three Major Site Characteristics

The San Antonio Oasis

The Mission San Antonio de Valero, now known as the Alamo, was established on May 1, 1718, as the first of seven settlements that clustered in the San Antonio River Valley by 1731. In addition to the five famous missions (Alamo, Concepción, San José, San Juan, and Espada), there was also a fort and a village. This concentration of settlement was unequaled in Spanish Texas. We can label the river valley "the San Antonio Oasis," a region of far higher carrying capacity than its surrounding hinterland.

The fort, or *presidio,* named San Antonio de Béxar, dates from 1722. Its center was Military Plaza, today occupied by City Hall. On the west side of the plaza, the elegantly restored Spanish Governor's Palace was the headquarters of a vast imperial province. The building was situated so that its rear patio overlooked San Pedro Creek, a tributary of the San Antonio River. Today, San Pedro Creek is little more than a drainage ditch.

The village of San Fernando was founded in 1731 by Canary Islanders and was centered on Plaza de las Islas (Plaza of the Islanders, now called Main Plaza). Originally laid out to the west of Military Plaza on the far side of San Pedro Creek, San Fernando was moved to the east side of Military Plaza, closer to the San Antonio River's west bank, for better access to water supplies. The magnificent San Fernando Cathedral, built in 1868 next to the walls of the old parish church, stands on the west side of the Main Plaza.

The village of San Fernando should not be confused with La Villita, a rather small settlement on the east bank of the San Antonio River that was founded perhaps several decades later. Also known as the "Town of the Alamo," La Villita once housed the families of soldiers using the then-abandoned mission for their livestock. La Villita sprung up on the Alamo side of a ford, the local low-water crossing of the San Antonio River flowing south between the two plazas and the mission.

The environmental basis of the San Antonio Oasis is the Edwards Aquifer, an underground reservoir fed by a recharge zone lying just to the north of the city along the Balcones Escarpment (Figure 5.1). Although the Spanish did not discover the aquifer itself, they paid close attention to the artesian springs scattered throughout the region. These springs flowed regardless of the unpredictable cycles of wet and dry years that characterize the semiarid climate of the region.

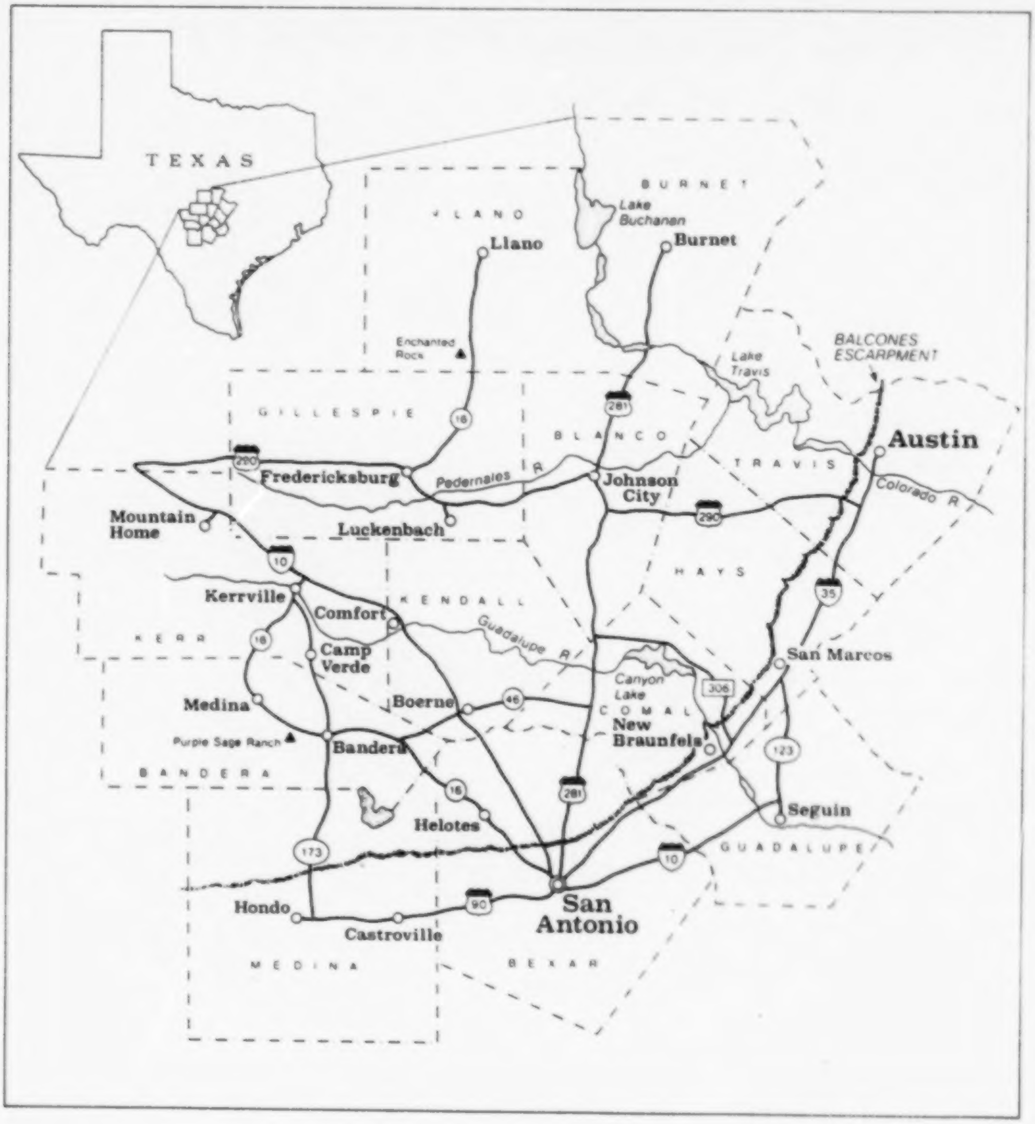

Figure 5.1: San Antonio and The Hill Country

The springs gushed forth from figurative holes in the Edwards (*bucket of water*) Aquifer. As long as the water level in the *bucket* stayed above the *holes*, the springs would flow. When the level dipped, the springs would dry up, although this never occurred until modern times. People in the region took the springs for granted until the relatively recent large-scale pumping of the Edwards Aquifer, made necessary by San Antonio's high-growth policies of urban development.

Even in times of prolonged drought, the artesian springs would flow, making the oasis attractive to the Indians inhabiting the region, as well as to the Spanish invaders who later displaced and Christianized them. What maximized water resources in the oasis were two springs in close proximity, each the headwaters of its own stream: San Pedro Springs (located in what is today San Pedro Park), which feeds San Pedro Creek; and San Antonio Springs (located on the present-day campus of Incarnate Word College), the source of the San Antonio River. The Alamo's

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original site lay near San Pedro Springs and was later moved twice to take better advantage of the downslope flow of water. In 1729, the King of Spain declared the area around San Pedro Springs an *ejido*, or public communal land, to conserve the integrity of this valuable resource, and thus San Pedro Park is considered the second-oldest park in North America (after Boston Common).

The oasis enabled the Spanish to establish a highly productive agricultural base, assisted by digging *acequias*, or irrigation ditches (Figure 5.2). They built several acequias directly from the two springs. They also constructed dams to pool water and divert the flow into the acequias. Concepción Dam, located on the San Antonio River near La Villita, allowed water to flow into the Acequia Concepción. The dam also aided transportation, creating a low-water ford below it.

Most acequias and dams no longer exist, but a wonderful exception remains. The water still flows in Acequia de Espada (west of the San Antonio River), running from the Espada Dam on the San Antonio River by aqueduct over Piedras Creek to the Espada Mission, watering fields that have been in continuous production since the mid-1700s. In Spanish times, irrigated crops included corn, beans, cotton, melons, and pumpkins grown for local consumption. Farmers raised cattle in the surrounding hinterland.

Within the abundantly watered oasis, downtown San Antonio, centered on the Military and Main plazas, lies in a smaller zone of maximum water accessibility. It is here that the San Pedro Creek and the San Antonio River come closest together before the creek curves westward. (The creek, however, joins the river at their confluence farther downstream.) In addition, it is here that the San Antonio River has a U-shaped meander (the site of the present River Walk), which facilitated accessibility to water and provided historic ford and bridge sites. Finally, it was here that the

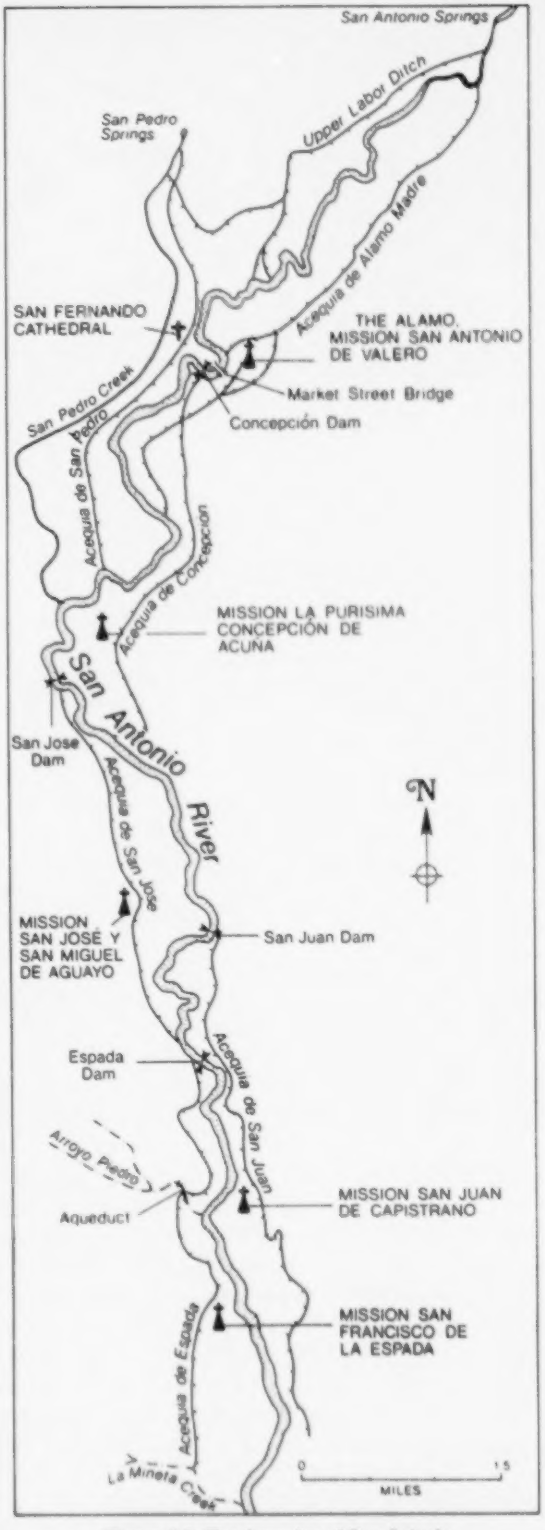

Figure 5.2: The Acequias of San Antonio
Source: Adapted from Hugill, Peter J. and Daryl Engel. 1982.

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Acequia San Pedro (also known as the Main Ditch) cut through Main Plaza, running directly in front of the cathedral. Nowhere else within the oasis was so much water available.

Topography

San Antonio lies on the fringe of the relatively flat Gulf Coastal Plain, just south of the Balcones Escarpment, a sharply demarcated line of hills that forms an abrupt physical boundary between the coastal plain and the Texas Hill Country (Figure 5.1). The Balcones Escarpment curves through Texas, and is oriented in two directions: north-south and then east-west. San Antonio is strategically located just south of the escarpment's bend, where the line of hills noticeably changes its directional trend.

Paralleling the north-south portion of the Balcones Escarpment is the Blackland Prairie, a flat and fertile region on the edge of the Gulf Coastal Plain. San Antonio lies on its southernmost extension into the oasis.

To the north of the city, along the Balcones Escarpment and in the recharge zone of the Edwards Aquifer, elevation abruptly increases from seven hundred to twelve hundred feet (210 to 370 meters) above sea level. Still farther north the Texas Hill Country (also known as the Edwards Plateau) begins, a moderately dissected limestone highland.

The Ecotone

An ecotone is a region of ecological transition, and San Antonio lies at the convergence of numerous environmental regions (Figure 5.3). These include: the flat grassland region of the Gulf Coastal Plain and its fertile Blackland Prairie; the more rugged Edwards Plateau, dominated by live oak and junipers (known locally as cedar); the South Texas Brush Country, also known as the Mesquite Plains; a finger-like projection of the Eastern Timbers; and the San Antonio River Valley, with its alluvial soils lined by riparian woodlands of live oak, cottonwood, and pecan trees.

San Antonio, therefore, lies within the classic prairie-forest ecotone, a region especially attractive to pioneer settlement. Wood was a critical natural resource, and the grasslands attracted agriculture and grazing. The San Antonio ecotone allowed for maximum exploitation of natural resources because of the wide variety of environmental conditions that boosted the already high carrying capacity of the land.

Stages in the Historical Geography of San Antonio

The Regional Capital of Spanish and Mexican Texas, 1718-1836

Only after 1700, with the French intrusion into the Lower Mississippi Valley, did the Spanish initiate settlement of Texas, developing a buffer zone between Mexico and French Louisiana. Both New Orleans and San Antonio share the same founding year of 1718. From the beginning, it was readily apparent to Spanish explorers that the San Antonio region was a superior one, but site characteristics were not the only considerations in determining the location of the buffer zone's regional capital and primate city.

San Antonio was at the transportation crossroads of Spanish Texas, and accessibility lay in three directions: from Mexico, across the Mesquite Plains; southeastward on the San Antonio River to La Bahia (Goliad); and along the natural highway of the Blackland Prairie to Nacogdoches. The change in orientation of the Balcones Escarpment from east-west to north-south was also a major factor in the alignment of transportation routes and the resulting centrality of San Antonio. The Edwards Plateau was an effective transportation barrier in Spanish Texas. Settlers avoided it as much for its rugged terrain as for the presence of Apache and Comanche Indians. Roads, therefore, were confined to the coastal plain, and the bend in the escarpment acted as a focus of transportation and trade.

Economic and political linkages were with Mexico, and San Antonio provided a strategically located administrative and support-service center for the northern frontier zone. The city's economic base was fourfold: the military, trade with Mexico, regional-capital functions, and the cattle industry.

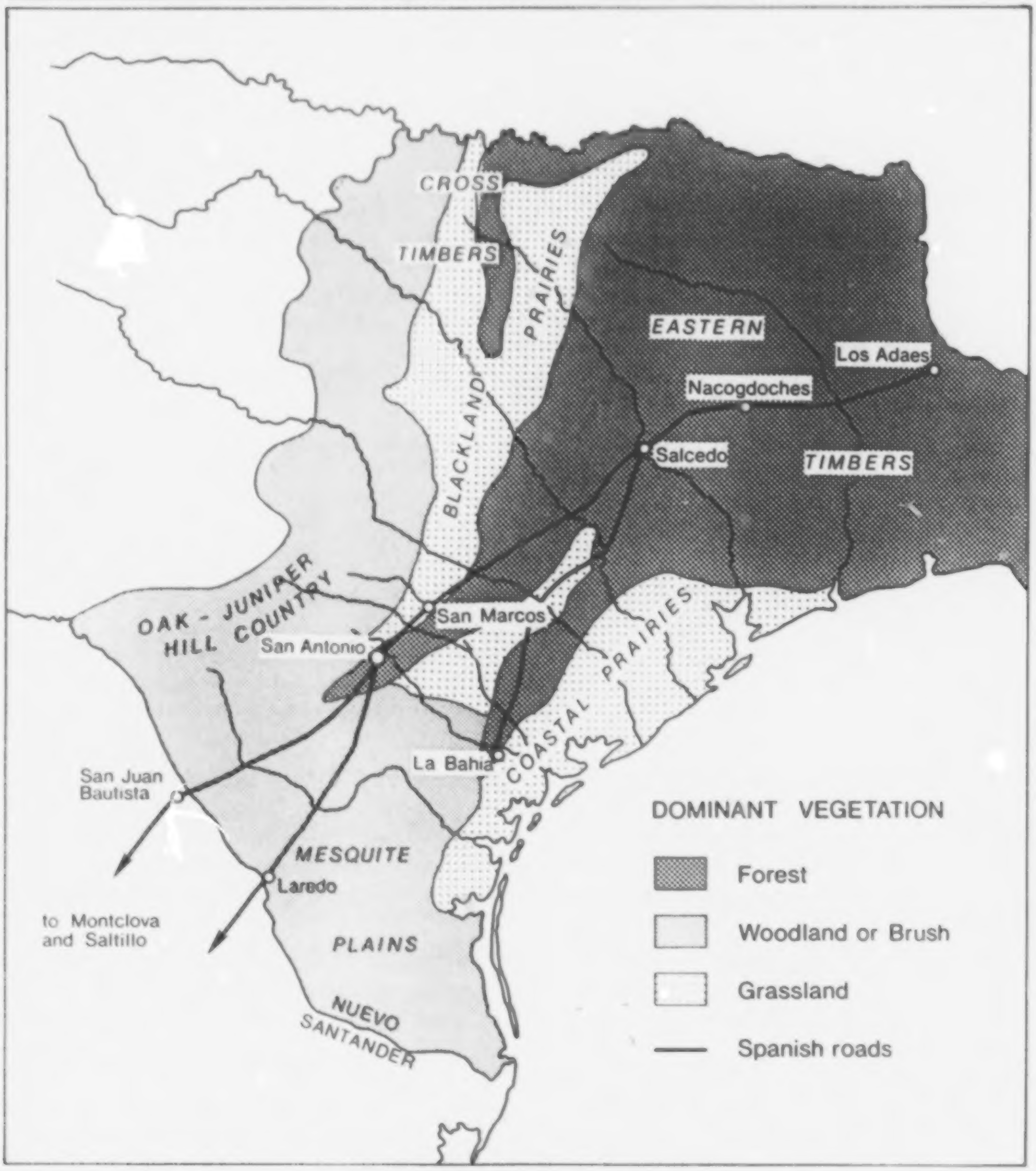

Figure 5.3: Natural Regions of Spanish Texas
Source: Adapted from Meinig, D. W. 1969.

After 1769, San Antonio declined in importance, as did the rest of Texas. Spain's rule of Louisiana undercut the need for a buffer zone, and the missions were secularized. Limited numbers of Anglo pioneers drifted in from the United States, and, in 1821, the independence of Mexico initiated a series of events that, in time, led to the Texas Revolution.

The Declining Frontier Town of Independent Texas, 1836-1845

With an independent Republic of Texas, massive situational change shifted the relative location of San Antonio from core to periphery. The reorientation of transportation routes had much to do with this new placement. All linkages with Mexico were cut, while an agricultural core emerged in the Colorado and Brazos river valleys to the east. The new core, based on cotton and sugar plantations, was enhanced by growing immigration from the U.S. South, primarily by road through East

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Texas. In addition, overseas migration of German, French, and other European immigrants began, through the Gulf ports of Indianola and Galveston.

Dating from 1817, Galveston was originally home to pirates, including Jean Lafitte of New Orleans fame. Its site and situation were superb for the transportation routes of the period. The port is located on the inland side of Galveston Island, just west of the entrance from the Gulf of Mexico into Galveston Bay.

Houston, the first capital of the Republic of Texas, was founded in 1836 at the head of navigation of Buffalo Bayou, a stream that flows from the west into Galveston Bay. Not accessible to ocean-going vessels until 1876, Houston developed a port based on coastal trade with Galveston. By 1839, the Texas government abandoned Houston (nicknamed at the time "Mud City") for Austin, escaping the stifling summer heat and humidity. But there was also a more dangerous threat. That year, with Houston's swamp-like drainage conditions, 240 people died in a yellow fever epidemic.

San Antonio, once the regional capital, was now a depopulated and dangerous town on the edge of the western frontier, an inland jumping-off point for the most hardy or foolhardy of pioneers. Hostile Indians and Mexican border warfare kept settlers from establishing sites much farther west, thus limiting San Antonio's hinterland. Castroville, established by the Alsatian impresario Henri Castro in 1844, was one example of such settlement, but it was years before it could be considered successful.

The Growing Frontier Town of Antebellum Texas, 1845-1861

After the U.S. victory in the Mexican War of 1846-1848, Mexican trade routes reopened, aiding in the economic fortunes of San Antonio. Old roads to the south found busier traffic, and new routes to the west were forged. With the California Gold Rush, miners and other fortune-seekers followed the Chihuahua Trail out of San Antonio.

A small railroad network developed in the East Texas core, connecting Galveston, Houston, and the Colorado and Brazos river valleys. This provided greater impetus to the growth of Galveston as Texas's chief port, and also to Houston, which developed as a railroad center, thanks to its key location to the northwest of Galveston Bay. In addition, improved transportation encouraged the settlement of the Texas frontier, which, while still dangerous, was becoming less so. Foreign immigration increased, and pioneers made their way into San Antonio's hinterland, such as the Poles, who settled Panna Maria (south of San Antonio), in 1854.

Other European immigrants made their living in town. The Irish came to San Antonio first, arriving with the U.S. Army in 1846. They worked as sutlers (provisioners) and teamsters for the army, which set up its quartermaster's depot in the abandoned Alamo. The area north and east of the Alamo came to be known as Irish Flat.

San Antonio also attracted Germans, who developed into San Antonio's merchant class. By 1856, one-third of San Antonio's inhabitants were German. In 1859, the fashionable Menger Hotel, located on Alamo Plaza, opened for business, and the streets of the King William neighborhood (named after Kaiser Wilhelm of Prussia) were laid out as the land survey was completed.

The Confederate Supply Depot and the Cowboy City, 1861-1877

As the War Between the States brought about a blockade of Confederate ports, alternative trade routes had to be developed to export cotton from the South. Roads from San Antonio to Mexico were busier than ever, as cotton was exported overland via Mexico. Trails to the western frontier were strategic as well. San Antonio's military significance in the Civil War was as a central supply depot for the relatively small-scale war fought in the West.

After the Civil War, the depressed San Antonio economy was stimulated by the quartermasters of the occupying United States Army. Greater fortunes were soon to come. Ranchers and farmers returned to their land to discover enormous herds of wild cattle roaming on the open range. Some estimates placed the number of cattle in the state at almost five million head. Spanish cattle had been multiplying unchecked since the days of the Texas Revolution, especially in a diamond-shaped region of South Texas centered on the Nueces River Valley (west of San Antonio) and bounded to the north by the city of San Antonio. This was the original home range of the American cattle business.

The Civil War had depleted the cattle of the Middle West, and cattle there sold for thirty to forty dollars a head, while they were one-tenth the price in South Texas. The cattle raisers forged trails, such as the Chisholm, north from San Antonio to the transcontinental railroads being built across Missouri and Kansas. San Antonio became the jumping-off point and outfitting center for many cattle drives, and it was the place for both cowboys and cattle barons to have a good time before leaving on the trail north.

Although Galveston continued to reign as the primate city of Texas, the 1870s saw the growth of Ft. Worth and Dallas. Increased in-migration, the forging of economic ties with the rest of the country, and the expansion of the Texas railroad network were growth catalysts. Ft. Worth developed as a central place for the Texas Great Plains, first as a stop on the Chisholm Trail at the south-side western crossing of the Trinity River for cattle headed north. After the railroad arrived in 1876, Ft. Worth evolved as a stockyard and slaughterhouse center for the transshipment of cattle and meat products to eastern and midwestern markets. The railroad network brought not only economic development but also change, and the era of cattle drives gradually came to a close.

Dallas grew as the north-side eastern crossing of the Trinity River for settlers from the Midwest and Upper South heading south into Texas on the natural highway of the Blackland Prairie. Promoted by businessmen from St. Louis and Chicago, Dallas developed excellent commercial linkages with the two cities. When the railroad came in 1872, it connected Dallas to the Midwest and the American Heartland.

The high price of wool and the availability of free range encouraged the expansion of sheep ranching throughout West Texas, and San Antonio also developed as its center. In fact, San Antonio witnessed increased prosperity throughout this era, continuing to grow as a second-order Texas city—primarily as a military, trade, commercial, and market center with a ranching-based hinterland. The arrival of the railroad was awaited with great anticipation.

The Railroad City, 1877-1890

On February 19, 1877, the Galveston, Harrisburg, and San Antonio Railroad finally reached San Antonio. This event, vital for commercial success, provided an economic foundation for San Antonio to emerge as Texas's primate city in 1890. These years, therefore, saw the expansion of the city's economic base industries. The railroad was extended into Mexico in 1882, and San Antonio was now firmly situated as a *transportation hinge* between the United States and Mexico, enjoying a virtual monopoly as the center for Mexican trade.

Cattle production in San Antonio's hinterland expanded, because the railroad provided access to national markets. The railroad also allowed cattle ranchers the opportunity to replace the hardy longhorn with heavier and more profitable breeds, since the cattle no longer had to face a long and difficult trail-drive north. In 1889, the San Antonio Stockyards were built adjacent to the Southern Pacific Railroad.

San Antonio continued to grow as a key military post. With the promise of railroad connections, the U.S. Army built the Quadrangle of Fort Sam Houston in 1876 as the central command, supply, and logistics post for the pacification of the Indian frontier. In 1886, the defeated Apache warrior Geronimo was imprisoned here for forty days. Black Buffalo Soldiers fought in Texas's Indian Wars, and an African American community grew around the fort on the city's east side. As San Antonio grew, so did its hinterland. San Antonio was clearly the regional capital of a dynamic South Texas region.

The Primate City of Texas, 1890-1930

By 1890, San Antonio eclipsed Galveston as the largest city in Texas, and the "Alamo City" entered its golden age. Population had tripled in twenty years (to about 38,000 in 1890), and the four economic base industries continued to boom at a rate that transformed San Antonio into the primate city of Texas.

In addition to cattle, San Antonio became a leading center for exporting horses, sheep and wool, and goats. Trade with Mexico was of continuing significance. Increasing population bestowed even more importance to San Antonio's role as the regional capital of South Texas, providing dry goods and financial services for its growing trade area.

The most dynamic sector of the economy was the military. Theodore Roosevelt organized, recruited, and trained his Rough Riders here in 1898. In 1910, the first military airplane flight in the U.S. took off from Fort Sam Houston. Revolution in Mexico meant uncertainty on the border. In 1916, General Pershing established his command center at the fort. From here, his troops pursued Pancho Villa into Mexico. By 1917, the U.S. Army had established Kelly Field as a key aviation depot and pilot training school.

One site characteristic was altered to accommodate San Antonio's rapid growth. In 1890, the first artesian wells penetrated the Edwards Aquifer. By 1895, all city water was taken from artesian wells, and the city's expanding population no longer depended on the relatively limited quantities of surface water.

During this time period, San Antonio attracted large numbers of Mexican immigrants. Many of these migrants were members of the Mexican upper class who sought haven from revolution and political instability. Most, however, were poor, having come to Texas to pick cotton, the production of which had greatly expanded throughout Central and South Texas—far beyond the boundaries of present-day cotton production. These immigrants settled to the west of San Pedro Creek, and so the west side developed as Mexican San Antonio.

After 1930, San Antonio would continue to grow, but large-scale situational shifts were taking place, fully incorporating Texas into the national and international economy. Two other cities, Houston and Dallas, were better located to take full advantage of this new economic integration.

Modern San Antonio, 1931-Present

By 1930, both Houston and Dallas had surpassed San Antonio in population, with Houston crowned as the primate city of the state. The top three rankings of 1930 are the same top three today: Houston, Dallas, and then San Antonio, Texas's third-largest city with a present-day metropolitan population of about one million.

To understand why San Antonio did not retain primate-city status, it is necessary to comment briefly on the growth of Houston and Dallas. It is not so much that San Antonio lost ground, but that these other cities acquired higher-order positions by virtue of their more advantageous locations relative to newly emerging transportation routes and newly important natural resources. San Antonio's relative location did not and could not change with the times.

Houston inaugurated its twenty-five-foot-deep (seven and a half meter) ship channel in 1914, the same year that the Panama Canal opened, bringing new business to Gulf ports. The channel penetrates fifty miles (eighty kilometers) inland up Galveston Bay and into Buffalo Bayou, presenting a distinct advantage to the Port of Houston over Galveston. Galveston was in decline; the city had been wiped out by this country's largest natural disaster, the hurricane of 1900, which killed six thousand people. In addition, Galveston had never developed as a railroad center. Its location on a barrier island was a bottleneck, with only one railroad bridge to the mainland. Houston, however, now connected the ship channel to an integrated railroad network.

One of the most famous events in Texas history was the discovery of oil on the Gulf Coast. Goose Creek in Baytown was one oil field among many, but it was discovered adjacent to the ship channel. Houston's central business district was soon to be the location for many headquarters of oil companies, but the city's economy also boomed as the oil-based industrial sector developed. Refineries, petrochemical plants, and oil and pipeline equipment manufacturers sprung up along the ship channel and on the city's east side. San Antonio could not match Houston's port and oil-based economy.

Dallas grew as a gateway between Texas and the rest of the United States, based on its longstanding ties to the Midwest. As the national economy expanded, firms operating out of Chicago and St. Louis selected Dallas as the site of regional banking and insurance-company headquarters. Its status as a business center grew, and so did its ability to attract national corporate headquarters later on.

The relative location of Dallas also determined its evolution as a regional trade center for the South-Central United States, maturing from its earlier status as the wholesaling and distribution center of Texas. The city's industry also reflected both its Midwestern roots and Sunbelt location. Automobile assembly and defense contracting are two types of Dallas's generally nonpolluting industrial base, which provides much contrast between this *clean* city and *dirty* Houston. San Antonio could not compete with the all-American relative location of Dallas.

The Relative Location of San Antonio

A glance back at the four economic base industries of Spanish San Antonio (the military, trade with Mexico, regional-capital functions, and the cattle industry) explains much of San Antonio's economy today. The city's relative location within the region has not changed significantly over the almost three centuries since its founding in 1718. The cattle industry still thrives in the hinterland, and the Alamo City has maintained its status as the regional capital of South Texas. A closer look at the two other contributions to the San Antonio economy—the military and trade with Mexico—reveals even closer ties between the past, present, and future.

The relative location of San Antonio has always placed it on the hinge, or gateway, between Mexico and Texas. The business of trade with Mexico is integral to San Antonio's heritage, and the city recently celebrated the passage of the North American Free Trade Agreement (NAFTA). It is important to note, however, that NAFTA only enhanced San Antonio's situation; it did not fundamentally alter it.

Perhaps most significantly, the city is poised to take full advantage of NAFTA's economic benefits. San Antonio is a bicultural city, with Mexican Americans making up about 55 percent of the population (San Antonio Hispanic Chamber of Commerce 1992). It is the cultural hearth and capital of Mexican America. A large bilingual Hispanic middle class stands poised on the economic interface between Mexico and Texas. Telemarketing firms, such as QVC (a home-shopping channel), with a vital need for bilingual employees, have located here to tap this labor market. The move of Southwestern Bell's headquarters from St. Louis to San Antonio was in part to take advantage of the Mexico connection. Here we have a modern-day example of San Antonio's relative location, this time on the information superhighway.

San Antonio has five military bases: Fort Sam Houston, and four Air Force bases (Lackland, Kelly, Brooks, and Randolph). Situation and site play an important role in this concentration. Proximity to Latin America, a regional question-mark when it comes to political stability, is one basis for San Antonio's favored location. The site consideration is San Antonio's fair-weather climate, which is excellent for aviation, especially pilot training.

In addition, the San Antonio Oasis still exists, thanks to the Edwards Aquifer, heavily tapped by artesian wells despite the semiarid climate. The perception of most residents is that ample water supplies remain in the aquifer to support the city's fast-growth economic policies. This is a well-watered city, whose centerpiece is the River Walk. Where else in the Southwest, even on its margins, could you have a Sea World theme park, two hundred miles (three hundred and twenty kilometers) from the nearest salt water?

Tourism, one of San Antonio's most vital economic bases, therefore, centers on the interplay of two factors: its unique cultural heritage and landscape derived from its Spanish roots; and the creative use of its water resources, the modern-day version of the Spanish acequia system.

The Texas core region includes four major cities with functionally-integrated economies. In other words, the economic specializations of Houston, Dallas, Austin, and San Antonio are complementary and interdependent. In addition, their sites and situations circumscribe the economic base industries of each city.

Houston's key site characteristic is its location at the head of navigation on Buffalo Bayou, a stream that flows into Galveston Bay. Situated as the "International City of Texas," Houston is oriented as a gateway between the core and the rest of the world. The international oil businesses and its port are Houston's principal integrated economic bases.

The site of Dallas lies at a key Trinity River crossing on the natural highway of the Blackland Prairie, running parallel to the Balcones Escarpment. Dallas is the "American-Texas City," with its orientation directed toward the American Heartland. Located at the interface between Texas and the rest of the United States, Dallas's key economic bases are commerce and distribution.

Austin is the "Silicon City of Texas" and has close ties to other U.S. regions of high-technology industrial development. Sited on a location destined to become a city regardless of its selection as the capital, Austin's importance in the Texas core is for its capital function and the presence of the University of Texas. Its economic bases are government, education, and high-technology industries.

Finally, San Antonio's key site characteristic is the water resources of the Edwards Aquifer. It is the "Texas-Mexican City," oriented toward its South Texas hinterland and Mexico. The Alamo City makes an important contribution to the functionally integrated Texas economy with its base industries of military and tourism.

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A Bicultural Geography of the Alamo

6

Miguel De Oliver

The popular perception of the Alamo is that within the mission's walls a collection of defenders who were primarily Anglo-Americans took the first definitive stride for Texas independence from Mexico. These defenders voluntarily sacrificed themselves in a noble stand for freedom against the numerically superior forces of General Santa Anna, who represented the undemocratic Mexican state of 1836. This most conspicuous launching-point in the birth of Texas is credited to the apparent act of mass martyrdom at the Alamo. Inspired by the events at the Alamo, Texan patriots succeeded in defeating Santa Anna's army six weeks later at San Jacinto, resulting in the independence of Texas.

The Alamo as a state-owned tourist attraction and a site of historical preservation is a twentieth-century creation brought about by the Texas women's patriotic organization known as the Daughters of the Republic of Texas (DRT). In 1905 the state of Texas formally appointed this private, Anglo-dominated organization to be the Alamo's custodian. To the continuing displeasure of various Latino organizations, the DRT has shaped the character of the Alamo's presentation ever since.

San Antonio and Texas Demographics

San Antonio is a Latino city. San Antonio has a greater percentage of Latinos (60 percent) than Texas as a whole (25 percent), and the metropolitan statistical area has the seventh-largest Latino population in the country (San Antonio Hispanic Chamber of Commerce 1992). Corresponding to its Anglo-Latino pluralism, San Antonio is situated within a broad socioeconomic and cultural transition zone between Anglo-America and the Latino Southwest (Figure 6.1). The average 1990 per-capita income of the Texas counties that are numerically dominated by Latinos represents a mere seventy-three percent of the per-capita income of the Anglo-dominated counties. South Texas also has the lowest per-capita income of any major trading area in the U.S., making it the poorest region of the country.

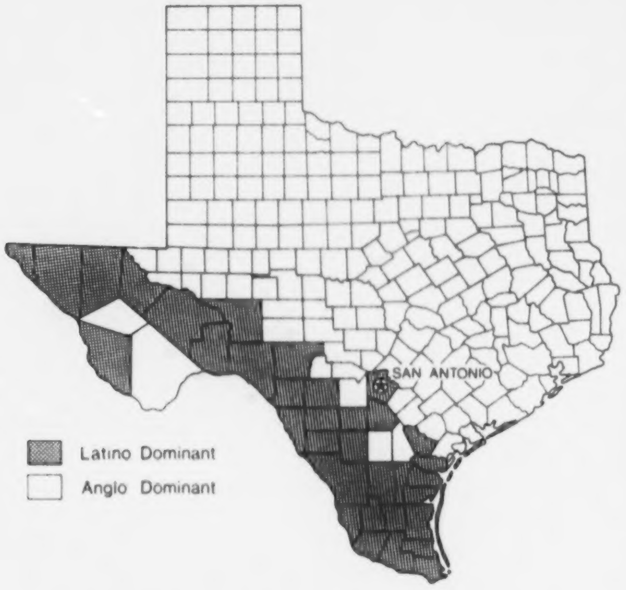

Figure 6.1: Latino- and Anglo-Dominant Counties in Texas
Source: U.S. Bureau of the Census, 1990.

Among the thirty-four economically underdeveloped Latino counties in Texas, Bexar County, in which San Antonio is located, has the second-highest per-capita income (second only to sparsely populated Terrell County), making it a regional exception (*Commercial Atlas and Marketing Guide* 1992). This relative wealth is due in large part to its local economy. In addition to a substantial mili-

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tary establishment, the local economy is based on the pivotal industry of tourism, which is heavily dependent on an ambiguous blend of popular associations with Anglo and Latino cultures. The Alamo is the tourist attraction that has the largest public profile and visitation rates, not only in San Antonio, but also in the state of Texas. Within the South Texas cultural transition zone, the Alamo epitomizes a cultural attraction that depends upon a fusion of Anglo and Latino associations. The manner in which these elements fused in the physical monument and its popular profile reflects patterns of rivalry between the two cultures.

As state-appointed custodians of the Alamo and the site's principal promoters, the DRT itself initially represented a fusion of Latino and Anglo interests by way of its bicultural membership (De Zavala 1917). This pluralism continued until the first decade of the twentieth century. The DRT comprised two factions, which had different conceptions of the Alamo and how it should be restored and presented. One faction was the De Zavala faction. Adina De Zavala, a Latino-Texan, wished to restore the Alamo to its original condition as a Spanish mission. Clara Driscoll, an Anglo-Texan, wished to alter the site so as to emphasize the events relative to the Anglo martyrs. The Anglo-Texan preservation plan prevailed, and the Latino-Texan faction of the DRT was expelled, leaving behind an Anglo organization fully committed to an Anglo-Texan agenda of historical preservation that would preside over the progressive alteration of the site throughout the twentieth century. The result was an eccentric amalgam of both cultures called the Alamo, whose profile heavily depends upon the site's historical and contemporary location in a region of cultural transition.

The Physical Alamo as Cultural Composite

The location of San Antonio between two culture regions materially reflects the Alamo memorial itself. The original Catholic trace of the mission has been drastically altered and presently is situated as a showcase for the Anglo-American interpretation of the siege. To this end, the chapel facade was emphasized as the symbolic front door of the Anglo-American Alamo, while the surrounding structures were either omitted or reduced in size during the preservation work. The very symbol the Anglo-Texan custodians chose to represent the Alamo—the Spanish chapel facade—was also to undergo cultural modifications. The exact origin of the idea for the now-famous Alamo parapet, constructed on top of the chapel, is unknown, but the two German contractors who reconstructed it clearly did not employ a Spanish Baroque design (see Eaton 1980). Schoelwer and Gläser (1985) identify the arched headboard styling as characteristic of urban Dutch architecture (Figure 6.2).

Acquiring new grounds to the immediate rear (east) of the Alamo in 1931 allowed for the construction of a botanical park in a style reminiscent of those found in western European. These grounds were never part of the original Alamo grounds, but they have nevertheless been materially incorporated into the complex, tacitly suggesting that they were within the perimeter of the Alamo fortress in 1836 (Figure 6.3). The Alamo garden park, constructed on these new grounds, combines period elements of European garden parks. The employment of a radial pattern for the garden park, along with the inclusion of a formal structure (the chapel) at the focal point of the garden, reflects the eighteenth-century English fondness for the placement of classical temples in gardens (Turner 1986). The classical structure in the heart of the European garden represented the central axis of sacred space in the park (Vercelloni 1990). The location of the mission chapel, therefore, signifies the status of this building as the most sacred space designated by the contemporary custodians in the Alamo garden park, even though the chapel itself was militarily immaterial to the events of 1836.

In addition, the function of the complex reveals a new cultural framework. The Alamo garden park plays a role corresponding to that of the central-city park that was emerging in the Europe and the United States during the nineteenth century. The nineteenth-century city park was an urban green area open to all. It was designed, in part, to promote certain behavioral and moral standards for those who used it (Messot and Teyssot 1991). The Western European tradition saw the urban park as a place of meditation and respite in the heart of the decadent metropolis. This function parallels the Alamo's role as a temple or shrine to historical Anglo-Texan ideals in a re-

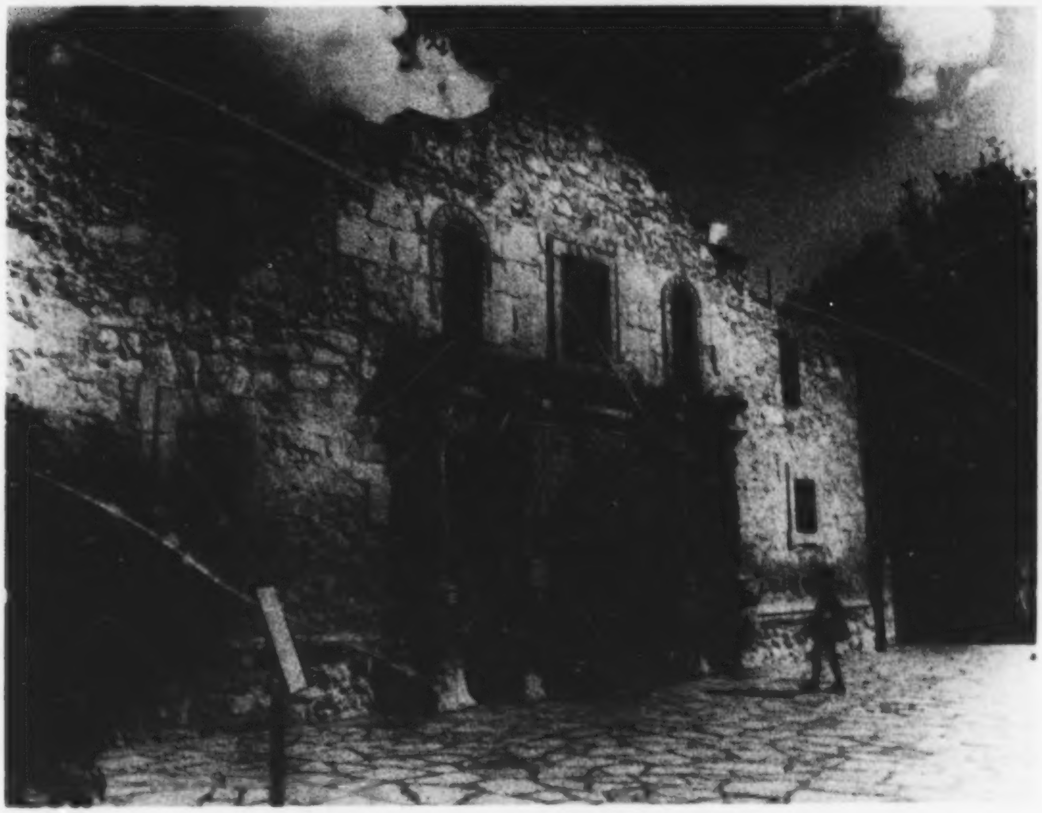

Figure 6.2: The Familiar Facade of the Alamo Mission Chapel
Note the different masonry construction of the upper arch compared to the original walls of the mission chapel.
Photograph courtesy of the San Antonio Convention and Visitor's Bureau, 1994.

pressive state. With the exception of the gift shop, a tour through the Alamo is characterized by an atmosphere of hushed tones that provoke a solemn reserve among the clientele. These are but a few of the modifications that have produced a composite cultural complex. Although the Alamo is a cultural composite geographically located between two culture regions, the character of its bicultural composition reflects cultural rivalry, not mutual tribute.

The Anglo administration of the tourist attraction and the dominance of the Anglo historical narrative have been fundamental to the popular profile of the Alamo. The Alamo as cultural icon finds its most prominent expression through its association with commercial enterprise.

The Alamo as Emblem

First a mission, then a fort; now a shrine that attracts tourists from all over the world, the Alamo is a universal symbol of people's dedication and integrity—concepts that also stand as time-honored attributes of any successful business enterprise. Firms using this familiar, yet inspiring shape as their logo, advertising, marketing or direct mail theme can be certain of making a lasting impression (Michelle Friesenhahn Design 1986, 3).

Not surprisingly, the cultural profile of the Alamo is most vigorously articulated by the premier mechanism of contemporary cultural production: commerce. Business enterprises seized the perception of the Alamo as embodying fundamental cultural values that envisioned their economic missions in the same noble terms. For example, John Lahourcade, president and chief executive officer of Luby's Cafeteria (which sponsors the IMAX Alamo movie in the Rivercenter Mall), states: "The message of the Alamo...is fundamental. It takes effort and sacrifice to succeed. This was true

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not only for the heroes of the Alamo, but for our own business as well" (quoted in IMAX Film Announcement 1987, 6).

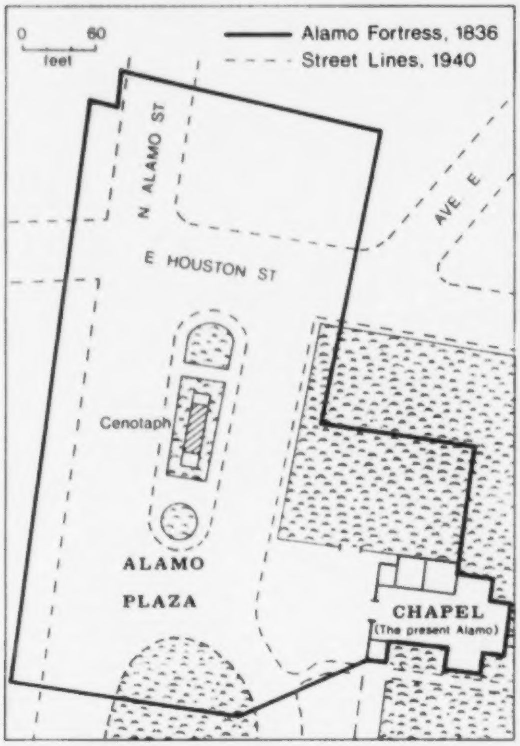

Figure 6.3: Location of the Original Alamo Fortress Walls
Source: Adapted from Davis, J. Frank. 1940.

Another result of the Alamo phenomenon in the popular culture has been the economic value of the Alamo as commercial emblem. The roster of Alamo business names, as well as companies using the emblematic chapel facade as their symbol or logo, spans the commercial spectrum from auto dealerships to game arcades. Full-scale replicas are even used as private homes (Schoelwer and Gläser 1985). The most conspicuous use of the Alamo emblem is the "Alamodome," a huge domed stadium costing more than $177 million, with a seating capacity of 73,200. In addition to other events, the Alamodome will serve as the venue for the New Year's Eve debut of post-season collegiate football in San Antonio, an event called the "Alamo Bowl."

The growth of such enterprises wishing to profit from association with the culturally redesigned Alamo by naming themselves after the site has been remarkable. Over the past century, the rate of increase in the use of "Alamo" in business names has been consistently higher than the population growth rate. In 1890, no businesses employed that title, but since the early twentieth century, as the DRT established and promoted what would become the foundation for the culturally redesigned Alamo, the exploitation of that name has grown. The local exploitation of the Alamo as a business symbol increased sharply in the 1960s, with the explosion of the tourism and convention industries in the 1960s, accompanied by an escalating municipal advertising budget (City of San Antonio 1951-1992).

San Antonio's tourism development centers on the Alamo, which is Texas's premier tourist attraction, followed by the Alamo's economic extension, the Riverwalk, as the number-two attraction (Texas Department of Transportation 1993). Thus, the Alamo image is central to the city's tourist trade. As stated in the *San Antonio Express-News* (June 21, 1981, 1G), "Like detergents, new cars and beer, San Antonio's tourist trade is sold to its consumers, those people from out of town with cameras around their necks."

The Anglo-Latino antinomy inherent in both the Alamo and its popular associations is a cultural construction that is synchronized to the transitional culture region that generated them. It is within this transitional zone that the cultural symbolism associated with the Alamo best contrasts elements of Anglo-America against non-Anglo culture. The Alamo as commercial emblem has a notable geographical expression suggestive of its cultural meaning and role.

Regional Use of the Alamo as Emblem

The popular perception of the Alamo coexists in the public mind with other psychological associations thematically linked to this *shrine* and that extend much farther than the confines of San Antonio. Using urban units throughout Texas, one can readily map the geographic distribution and frequency of the name "Alamo" in business names. *Alamo* is the Spanish word for the cottonwood tree, so it is conceivable that this usage might reflect itself in the incidence of Alamo as commercial title. It does not overtly affect the data, however, since the contemporary celebrity of the socially constructed Alamo far eclipses the celebrity of the Alamo defined as cottonwood tree. Its market recognition is that of the memorial—a conclusion supported by a representative of the Chamber of Commerce of the city of Alamo, who informed the author that the city adopted Alamo as its name in 1924 after the cottonwood tree, but it is overwhelmingly misidentified with the Alamo memorial. In addition, the presence of cottonwoods in other areas of Texas, whether Latino-dominated or not, is not reflected in the level of local occurrences of Alamo as commercial title, nor is the business title well-employed on the Mexican side of the border (as would be expected if Alamo referred simply to the cottonwood.)

Areas of high Alamo usage span an arc from West Texas southeastward through San Antonio to the Gulf Coast (Figure 6.4). The second-highest region of occurrences is located south of San Antonio along the border with Mexico. Included in this second area is the city of Alamo, located directly on the border. This distribution does not represent a simple distance-decay effect from San Antonio, because the high incidence occurring along this arc and to the south-southwest of San Antonio is not duplicated to the north-northeast. The result is a distinct zone of high incidence occurring primarily in the South Texas territorial salient that is roughly delimited in the north by the latitude of San Antonio. To provide a medium for interpreting this distribution, it is necessary to examine population and ethnicity demographics statewide.

The population distribution of Texas is overwhelmingly concentrated in the more humid central and eastern portions of the state. The southern tier of Texas is numerically dominated by Latinos (see Figure 6.1). South Texas, therefore, is a region in which Latino population is disproportionately concentrated. This region roughly corresponds to the South Texas region in which a high incidence of Alamo in commercial names occurs (Figure 6.4). The arc of high Alamo occurrences coincides with the cultural border between Latino-dominated counties and Anglo-Texan dominated counties.

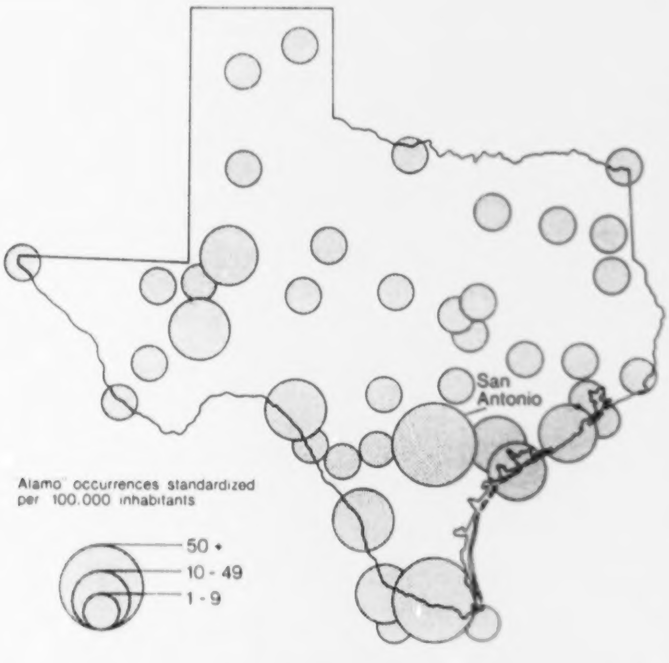

Figure 6.4: Distribution of "Alamo" Usage in Texas Business Names
Sources: American Telegraph and Telephone Company, 1993; Southwestern Bell Telephone, 1993; U.S. Bureau of the Census, 1990.

With the overwhelming predominance of Latinos in South Texas, as well as the region's location directly confronting Mexico and its citizens, the Alamo emblem is (however intuitively) a collective expression of Anglo-Texan cultural insecurity in a region dominated numerically by Latinos. The border towns that have a high incidence of Alamo occurrences in the McAllen-Brownsville area are 90 percent Latino (San Antonio Hispanic Chamber of Commerce 1992). Thus, the string of high incidence along the border represents a symbolic Alamo *picket line* of sorts, where the concentration of Latino population is the highest and the presence of Mexico the most immediate.

Because national jurisdiction over Texas is not at issue today as it was in 1836, it is safe to assume that contemporary meanings that are psychologically linked to the popular Alamo provide an explanation for the higher incidence of Alamo use in the more heavily Latino-dominated border region of South Texas. The culturally redesigned Alamo provides more than simple cultural flattery to broad segments of the U.S. audience; rather, it resounds so strongly with the perceived national values of struggle, sacrifice, and freedom that it has been employed by a substantial proportion of the Anglo-American public as a sympathetic vessel to "promote some particular political or social cause" (Hutton 1986, 5). The Alamo, therefore, serves as surrogate messenger in response to problems psychologically associated with the monument's social role (see Lofaro and Cummings 1989).

These associations, however subtle and expanded to represent success and social status, become a desirable symbol of *cultural authority* to a greater extent in South Texas than anywhere else in the state, because of the increased presence of Latinos and decreased presence of traditional Anglo-Texan culture. This does not imply a general, conscious, and antagonistic motivation to the exploitation of the Alamo symbol, for such a motivation would not prove profitable for an entrepreneur dependent on a congenial patron-client relationship. Rather, to a larger degree, one might likely explain the employment of the Alamo symbol as a pragmatic exploitation of an existing meritorious symbol whose culturally biased pedigree is obscure to those who appropriate that symbol. Conversely, in the heavily Anglo-dominated central and eastern parts of the state, which are progressively more distant from the Texan portion of what Garreau (1981) calls "Mexamerica," the incidence of Alamo business names goes down, as the associated connotations identified with the Alamo are less relevant to the collective cultural security of Anglo-Texans in those regions.

With reference to contemporary museum exhibitions like the Alamo that are being created in a modernizing world, Karp and Lavine (1991, 1) write that "in the United States at this historical moment, especially given the worldwide interest in multicultural and intercultural issues...[groups are] attempting to establish and maintain a sense of community and to assert their social, political, and economic claims in the larger world." The cultural partisanship of the contemporary Alamo thus serves as an emblem representing the cultural authority of Anglo-Texans in a transitional culture zone.

Summary

Cultural geography has played a key role for both the Alamo of 1836 and the cultural symbol of the twentieth century. Located in a transition zone between Anglo and Latino culture regions, the historical monument represents a consciously integrated amalgam of both cultures. The twentieth-century integration of Latino and Anglo elements in the Alamo was designed to coincide with an Anglo perspective of the historical event, as well as to produce a symbol of cultural contrast. Presently, the Alamo as an Anglo symbol is most functional in this cultural transition zone, because, as Henry James (1909) suspected, the best place to view clear examples of socially constructed regional identity is at the margins of a distinct culture region.

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7 Germans in Texas: Deep in the Heart of San Antonio

Dona Reeves-Marquardt

On fall weekends in Central Texas, urbanites and suburbanites converge on feasts and festivals often associated with an ethnic heritage not easily found in larger cities. Hearty fare, sausage and beer, commotion punctuated by polkas and waltzes, all set a tone perceived as German. Some of these celebrations have traditions reaching back over a hundred years; others trace the recollection of lost traditions. Most blend old and new; many, the German and Texan. As the confluence of cultures, San Antonio supports the largest festival of all, the annual Texas Folklife Festival.

The smaller festivals set in rural communities can be considered metaphors of a distinctive immigrant history and culture. They distill the nature of German-Texan experience and extract the character of immigration and immigrant struggles. Departure from the old country brings difference. Immigrants lead a life distinct from the norm of the new land but also distinct from the norm of the old homeland. They bring something atypical and novel to their adoptive country while losing continuity with the country they have left. The process is complex and results in something like a third culture.

Today, German-Texan culture contrasts with the typical Texan, American, even German-American culture in at least three distinct ways. The first distinction is language: Germans in Texas make up the third-largest linguistic group in the state, after English and Spanish. The Germans have maintained their language for four or five generations, longer than German immigrants in other parts of the U.S. and, surprisingly, longer than Mexican immigrants retain Spanish in Texas (Gilbert 1975). The second distinction is a collective past: German-Texans have a unique history, separated not only physically, from their homeland, but also culturally, from Germans in other parts of the United States. The third distinction is solidarity: The cohesion of this group continues to modify life in small German-Texan communities in ways that differ subtly from Anglo-Texan or other ethnic communities.

Terry G. Jordan (1979) identifies two main concentrations of Germans in Texas (Figure 7.1). The eastern settlements are concentrated on the Brazos and Colorado rivers a bit north of the city of Houston. The western settlements are found mainly in the Hill Country north and west of San Antonio (Figure 7.2). Beyond these two areas, German linguistic islands stretch north and northwest as far as the Texas Panhandle and the Oklahoma border, points designating later settlements that resulted from secondary migrations (from the "German Belt" of Texas, from other parts of the U.S., and some directly from Europe). The early migrants were attracted to Texas primarily by the possibility of acquiring cheap land.

The History

Germans were in Texas as early as 1821, when some Germans settled in Stephen F. Austin's colony. By 1835, a Württemberger, Johann von Racknitz, attempted to establish a German colony on the lower Nueces River of South Texas. His plan failed because of the impending war with Mexico. A German or two even fell at the Alamo.

By 1831, however, Friedrich Ernst from Oldenburg settled permanently on Mill Creek in Austin County. Aside from the fact that he wasn't really Friedrich Ernst but Friedrich Dirks (G. Jordan 1979) and he hadn't left his homeland without suspicion, he is considered today to be "the father of German immigration to Texas." He deserves this title for a number of reasons. First, he remained in Texas until the end of his life. Second, he sent a famous and enthusiastic letter about Texas to a friend in Oldenburg, praising the beauty of the country and the abundance and fertility of the land, and intending, of course, to attract fellow Germans to his Texan neighborhood. Little

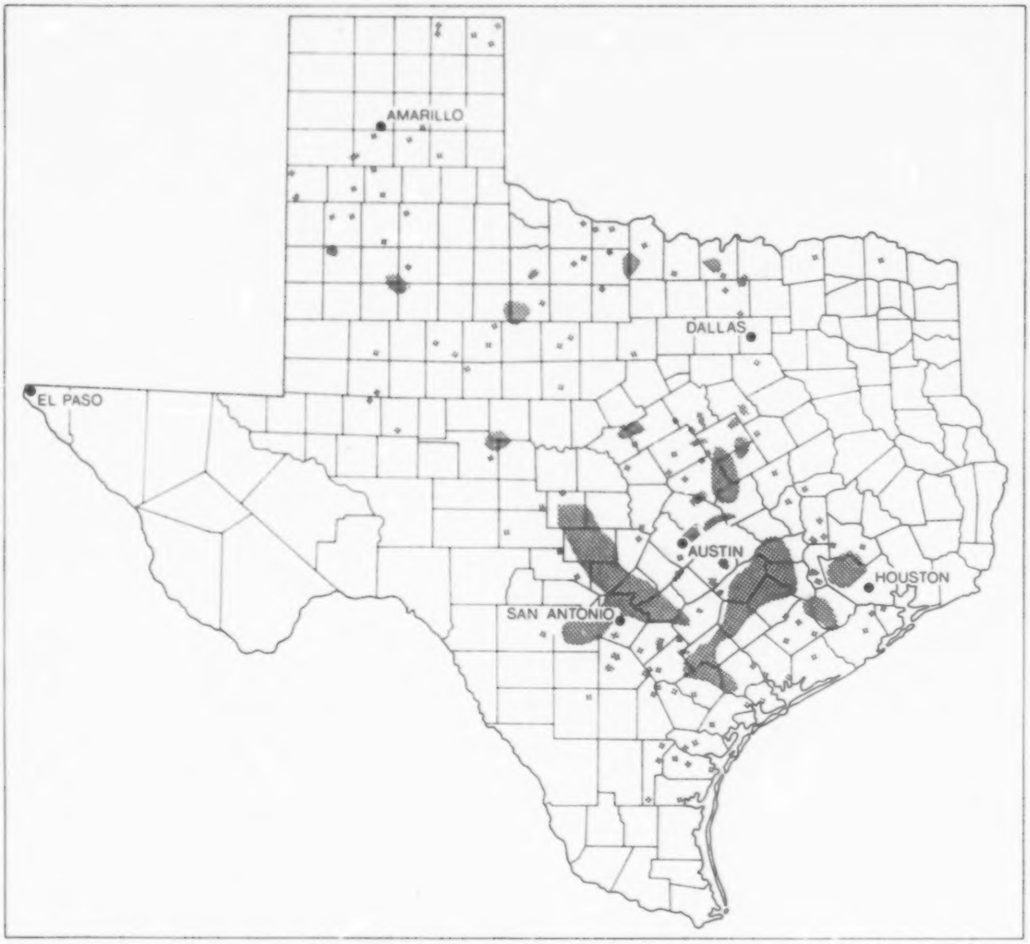

Figure 7.1: Distribution of German Settlements in Texas
Source: Adapted from Jordan, Terry G. 1979: 93.

did he know that his letter would be widely reprinted in German newspapers, enticing throngs of Oldenburgers, Hanoverians, and Westphalians to migrate to Texas where they hoped to become rich in a short while. (The text of his letter appears in Benjamin 1974, 17-19). Third, Friedrich Ernst helped many German immigrants establish themselves nearby. The Germans who arrived before 1836, however, had to participate in the Texas war for independence. They remained in Texas, raised "horses, cows, planted grain, married and had a house full of children" (Sörgel 1992, 104).

Still, the uncertainty of the political situation in the young Republic of Texas inhibited mass immigration from Germany before 1843. Individuals did come, romantic figures for the most part, seeking adventures in a distant land or a new life. Meanwhile, two concurrent events were happening, which would immeasurably influence developments in the next couple of decades.

In Europe, a group of noblemen, *der Verein zum Schutze deutscher Einwanderung in Texas* (Society for the Protection of German Immigration in Texas), gathered in Biebrich on the Rhine in 1842 with a number of specific aims: (1) to eradicate poverty from their realms; (2) to protect migrants traveling from their principalities to Texas; (3) to find new markets for their commercial interests; and (4) to gain an enormous profit from the venture for themselves. At the same time,

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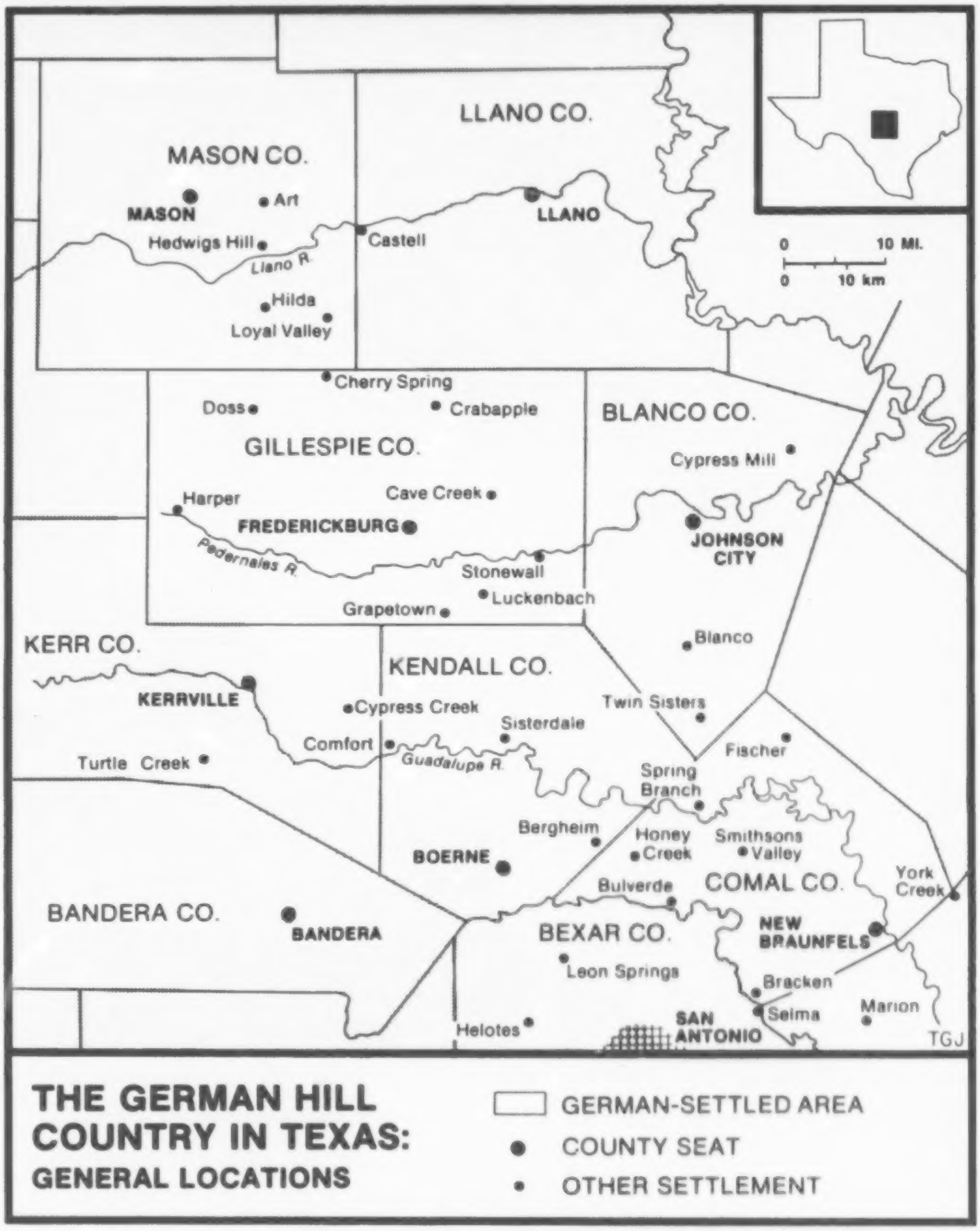

Figure 7.2: German Settlements in the Hill Country
Source: Jordan, Terry G. 1982.

impresarios in Texas were setting up speculative ventures, trusting either that Mexico would recognize Texas or the United States would annex it.

Three men, Bourgeois d'Orvanne, Henri Castro, and Henry Fisher succeeded in acquiring land granted tentatively by the new Republic of Texas. They, too, gambled upon German immigration. From their allied efforts, news about the so-called Fisher-Miller Grant, 3.8 million acres (1.5 million hectares) between the Llano and the Colorado rivers, appeared repeatedly in newspapers

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and brochures as the new promised land. The designs of land impresarios and noblemen converged, and they expected Texas to become a German colony.

The *Adelsverein*, or "Society" as it was called, promised migrants land, but it held no clear title to that land. The Society described the Fisher-Miller Grant as a paradise on earth, even though stockholders knew nothing about it and had never set foot on it. The Society obscured the enormous difficulty one might have in reaching the land. Society stockholders raised hopes that they were in no position to fulfill(Sörgel 1992).

The number of Germans who eventually came to Texas under the auspices of the *Adelsverein* cannot be known, it has been estimated from a low of seven thousand to a high of ten thousand. To prepare their way and make ready for the mass migration, the Society sent Bourgeois d'Orvanne as *Kolonialdirektor* and Prince Carl of Solms-Braunfels as *Kommissargeneral* to Texas by 1844. Prince Carl established the present city of New Braunfels as a station on the trek from the Gulf Coast to the Fisher-Miller Grant. When the Prince learned that 392 settlers (Geue and Geue 1972) in three ships were already on their way to Texas, he quickly built Karlshafen (Indianola) on the Gulf Coast as a harbor for their entrance to Texas. From this point the settlers would make their way up the Guadalupe River, a distance of more than two hundred miles (three hundred and twenty kilometers), to New Braunfels, the new station. Prince Carl then abruptly returned to Germany.

Soon after, the settlers did arrive in Karlshafen. They found no promised housing, no transportation, and a long delay awaiting them. A contemporary writer, Alwin Sörgel, poignantly describes the spoiled food, the undrinkable water, the summer heat, unsanitary conditions, and lewd behavior ascribed to drinking and the demoralizing situation (Sörgel 1992). The detainment at the coast was inevitable, since all wagons had been appropriated for the war against Mexico. Not wishing to sit still, some of the young men joined a German captain in the American army, Augustus Büchel, in the 1846 war against Mexico (Biesele 1987).

The land in the Fisher-Miller Grant was romantically beautiful, mountainous, isolated, and covered with stones, but for the most part it couldn't be farmed. Furthermore, Comanche Indians inhabited it. The new *Kommissargeneral* of the Society in Texas, Baron Otfried Hans von Meusebach, was ordered not only to clear up the financial difficulties of the Society but he was also supposed to lead the colonists to the grant.

This thirty-two-year-old Meusebach was himself a nobleman and a stockholder in the *Adelsverein*. A former mayor of the German town of Anklam, Meusebach not only had a fine education but he also had administrative experience. As Commissioner-General of the Society, he received a salary, five hundred acres (two hundred hectares) of land, and five thousand dollars in indemnity funds in case the Society failed within five years (as it in fact did). Meusebach's greatest achievement was to establish the town of Fredericksburg and to negotiate a treaty with the Indians, perhaps the only treaty with any Indian tribe in the history of the United States that has never been broken.

Nevertheless, by the beginning of 1847 (five years after the *Adelsverein* was established), not one foot had been placed in the Fisher-Miller Grant (Sörgel 1992). After Meusebach's treaty with the Indians, land surveyors could enter the grant area in peace, and after them, the German settlers. Sörgel (1992, 158) reports about this period and the Germans' differing treatment of the Indians:

> In general, the Indians are peaceful. They see in the conduct and actions of the Germans a distinct difference from that of the old-time Texans. Where the latter welcome them always with a rifle, the Germans treat them as humans. They invite them in their homes, allow them to sit by the fire, offer them bread and coffee and do some trading with them. Because of the kindness shown them, the Indians do not transfer to the German newcomers their old hostility against the Texans. This also explains why there has been no fighting or hostility between the two from the beginning.

The German artist, Richard Petri, who drowned in the Pedernales River a few years after his arrival in Texas, reveals the peacefulness of this relationship between Indians and Germans on the frontier. He depicts his Indian neighbors, particularly the women and children, with genuine sympathy and lively curiosity, while living in trusting proximity with them. Peace lasted for roughly fifteen years prior to the American Civil War. Then, occasional individual conflicts and the abduction of German children began to trouble frontier life.

The land was hard, and the newly arrived Germans had to learn how to deal with the Texas heat, the *Northers*, the rocks, the different kinds of insects, and the poisonous snakes. Mostly, they also had to learn how to become farmers. For many, it was all but impossible to make the transition. Some intellectuals had to follow oxen, where "all the geometry, the six languages and the logarithms...were of no help" (Goeth 1982, 41). On the other hand, anyone could become a prosperous farmer for little money and lots of work. Sörgel (1992, 78) writes of a differing class system:

> Here, there is no difference between farming with oxen or with horses, it is all one and the same. In Germany you are held in contempt if you earn your livelihood by working with your hands. Here work is honored, and a hard and calloused hand receives a heartier welcome than one that is delicate, soft, white and idle.

The Germans could not bear life without certain things in their new land. Accordingly, they brought German institutions along and transplanted them in Texas during those foundation years. Often, their efforts resulted in new, remarkable conventions that resisted time and became something intrinsically Texan.

We find one example in the theater groups they formed to present German drama to an eager audience. Houston, Galveston, and San Antonio boasted Casino Clubs, where German gentlemen went to play cards, smoke cigars, and organize festivals for special occasions. The Germans also created *Farmervereine* (agricultural societies) to aid in the transition to a new occupation, as well as to provide a base for social affairs. Even small settlements could afford a *Gesangverein* (a singing society). Today's *Staats-Sängerfest* (state singing festival) continues a tradition well established by 1856.

The Forty-Eighters (immigrants from Germany fleeing the consequences of the unsuccessful revolutions of 1848) contributed greatly to the cultural life of the Germans in Texas. They sustained German newspapers, reading clubs, and schools. They also brought along their books as well as their democratic, anti-oligarchic predisposition. Among their number was the philosopher and professor from Minden, Ernst Kapp. He settled his family in Sisterdale. Before he returned to Germany, he tried to establish a *Wasserkur* (hydrotherapeutic cure) on his farm, depicted now only in a drawing by the German-Texan artist, Hermann Lungkwitz. Kapp's descendants in Texas still point to the places where the cabins for the various baths stood. In addition, his house with its thick walls (provisional protection against feared Indian attacks) can still be found, nestled in a clearing between the Sister creeks. Here, in quiet harmony with his surroundings, Professor Kapp often discussed the philosophy of Feuerbach and Fourier with his neighbors. After visiting his uncle in Sisterdale, Kapp's nephew, Friedrich, wrote the following passage (Sass 1980, 98) to Ludwig Feuerbach, who also considered migrating to Texas at one time:

> I visited an uncle of mine there, the one who wrote the philosophical geography and who now is a farmer with his children on the Guadalupe. If I had any thought of spending my later years as a pious plowman and stock farmer, then I would go to this part of Texas.... The region is populated by a relatively large number of educated Germans with very little German riffraff.

This bucolic vision was rudely destroyed by the events of the American Civil War. For years, historians mistakenly assumed that the newly arrived Germans, having sworn allegiance to the United States so recently, aligned themselves solidly and in every respect with the Northern states, supporting the Union and abhorring slavery. Reality was, as usual, more complex.

In the western settlements, in the Hill Country, Germans knew well that they would lie vulnerable to Indian attacks when the Union troops were withdrawn from the few forts so far out on the frontier. Courageously, even brashly, and following their democratic anti-slavery convictions, a group of young men from Boerne, Comfort, and Sisterdale (sons of Forty-Eighters for the most part) even decided to ride to Mexico and from there to travel to the North to fight against the Confederate forces. Soon, opposing forces found and ambushed them. In Comfort, a monument stands in tribute to these young men, whose bones were gathered up after the attack and laid to rest there. It stands as the only monument to the Union in the entire South, and the inscription just happens to be in German.

The situation was not as simple in those parts of Texas where the Germans had settled earlier and where the fear of Indians was not so great. Not that the Germans were ardent slave holders—they were not (T. Jordan 1979). Known slave holders among them were the noblemen of the Adelsverein, in New Braunfels and in Nassau Farm, the headquarters of the Society, where fifteen slaves were found in the inventory of the Society (the *Solms-Braunfels Archiv*). Most Germans, however, were neither in a financial condition to buy slaves, nor did they know how to use them. Furthermore, they had large families with many children to help out with the field work. More likely, they simply had no interest at all in the question of slavery. Yet, hundreds of Germans joined units of the Confederate army, even forming entire German companies to defend Texas (not the Union) and to "recapture" Texas lands to the west and into Arizona, in an attempt to expand them perhaps as far as California with its strategic harbors (Pool 1975). The position of the Germans in the war is still a subject of lively debate.

Not only did the migrants want to but they *had* to get along with their Texan neighbors somehow, both during and after the war. Getting along with their Texan neighbors did not mean just with Anglo-Texans from other Southern states; it meant also getting along with settlers of Mexican heritage and with former slaves, as well as with other newly arrived folk-groups from Europe: Czechoslovakians, Poles (primarily from Silesia), and even Germans from Russia.

Artifacts and Remnants of a Culture

Today, German-Texan vestiges of the mid-nineteenth-century foundation years imprint the landscape as well as community and family life. Often hidden, German-Texan fragments persist in the composite leveling that is inevitable with the advance of time and urbanization. A keen focus can reveal these artifacts and remnants in places beyond New Braunfels and Fredericksburg.

Certainly, German settlement names remain: Bergheim, New Ulm, Schulenburg, Oldenburg, Berlin, and Kreutzberg, for example. Some names were changed during World War I; Bismarck, Texas, became Old Glory. Businesses, too, display German names derived from family or function (for example, *Das Blumenhaus* and *Altdorf Biergarten*). Many of them have existed for well over one hundred years. Their names remind us of their old—or not so old—origins.

A melding of native (vernacular Texan) and German architecture is still to be found. When the Germans arrived, they had to learn new and unfamiliar forms, among them the dog-trot house, an open but covered room set between two wooden huts. In the summer, this arrangement caught the cooling breezes from the Gulf and the family could use the space for work or for rest. In the winter, the space between the huts could be closed in some provisional manner to protect the house from the gusty north winds. Germans also learned how to shelter their houses and their businesses from the scorching Texas sun by adding a covered veranda (a so-called gallery). Likewise, it is easy to find add-ons and lean-tos. Such provisional structures became necessary as families became larger and finances allowed enlarging the house.

In the beginning, Germans built log houses, learning the art from local neighbors. Since many Germans came from Oldenburg, from the kingdom of Hanover, and from Hesse, they brought with them the thoroughly practical, advantageous, and well-known half-timber method of construction. Today, such structures are in high demand in Texas and claim high prices on the real-estate market. Wood for the timbers was plentiful, and the *Fächer* (the spaces between the supporting timbers) could be filled in with any available material—mud from the Comal or Guadalupe rivers, or even stone. Roofs were predominantly covered with tin to guard against fire.

As soon as people could, however, old-country ways were set aside, and they tried to build a *real* house of stone, not altogether like those in the old homeland but with characteristics of the new homeland (perhaps a two-storied house with a built-in gallery or a huge fireplace large enough to roast a whole ox on the spit). In time, the old half-timbered homes fell into disfavor. They were simply boarded over with the thoroughly American clapboards. It is often difficult today to detect whether a half-timbered construction is concealed beneath this covering.

The stonemasons, carpenters, and cabinet makers could also show off their crafts. Customarily, artisans could maintain a good income, and German handicrafts were in high demand. The need for German wagons and wagon makers soon disappeared, but numerous local museums painstakingly preserve artifacts such as chests, chairs, and trunks. Some undoubtedly came across the Atlantic to Texas many years ago; others were created locally by skills learned in more refined environments. These handicrafts linger and continue to develop, whether the material is wood, yarn, thread, or recycled textiles.

As soon as the immigrants had enough time, they also constructed churches, which stand either in the center of their communities or sometimes out in the country. In these churches we find the old German script in glass windows or cut in stone. Close by the churches and often connected with them, cemeteries bear witness to the connections between Texan and German art. The gravestones with their inscriptions have a German cast, not only in their language but in their conception. The ground of the cemetery is often swept bare to protect both the departed and the visitor from rattlesnakes. Wondrous vegetation often protects the grave from the unsparing rays of the Texas sun. Seashells carried from the Gulf Coast adorn many graves built in adopted soil. Such decorations are restricted mainly to German-Texan cemeteries. Iron crosses direct attention not only to names and dates but also to the art of the blacksmith. More often than in the cemeteries of the Anglo-Texans, we find a portrait of the departed, a typical European custom.

Weekends in the German Belt of Texas provide listeners with well-known melodies and an opportunity to dance the polka or schottisch. The music is an easy mixture of German and Czech (Bohemian and Moravian) elements, combined with a distinct Texan flavor. Such music became very popular, spreading even to Mexico. A reverse modern development can be found in the endorsement of Tex-Mex *conjunto* music, which happens to be highly regarded just now. In festivals, or simply in one of the ubiquitous village dance halls, bands play favored numbers on Saturday nights: *das Liechtensteiner Polka, Heili heilo ha ha,* and *Du, du liegst mir im Herzen,* melodies that may not find much favor today in modern Germany. It all goes along with happy conviviality and Lone Star beer.

The performances and celebrations of today's *Gesangvereine* are much more formal and ceremonious. The musical traditions of the German immigrants have continued for almost one hundred and fifty years without interruption. Isolated for decades without contact with the old homeland, groups now exchange fellowship and performances across the Atlantic with surprising regularity.

The maintenance of many German traditions are bound with the endurance of societies founded for beneficial purposes. Often the societies organize the festivals that we see as visible metaphors of the culture. Such festivals seem quaintly old-fashioned to the modern German visitor. They are not representative of Germany today, of course, but they bridge that vanished memory with the blended *third culture*. Halls of the Sons of Hermann, (a benevolent society and insurance company, so named in 1840 out of enthusiasm for the Germanic hero who defeated the Roman legions of Varus in A.D. 9), now serve as social centers where German-Texan community members come together to find their neighbors, exchange views, and play dominos. *Turnvereine* (gymnastic and social clubs, such as the *La Bahia Turnverein,* not far from Burton), *Farmervereine* (agricultural societies, as in the communities of Anhalt and Cat Spring), and *Schützenvereine* (rifle clubs, in Round Top, New Braunfels, and Fredericksburg) may have lost their original function, but they persist as community institutions.

Many other traditions endure in daily life and yearly cycles, such as the Christmas celebration and Christmas trees, rarely illuminating them as in the past with wax candles and using the Texas native juniper instead of *Tannenbäume* (fir trees). In their free time, German-Texans still bowl with nine pins, play *Skat*, and drink beer, if they are able to find some Texas Shiner Bock. In addition, a profusion of German recipes can still be found, some with an easy Texan coloration, like the prevailing smoked meat (barbecue) taking on the taste of Texan live oak, or German-Texan pies at a local fest. Furthermore, almost every family can point with pride to fragments of its own fragile past, be it a baptismal certificate, a passport, a quilt, or a friendship card.

German-Texan San Antonio

Following the Texan revolution and the fall of the Alamo in 1836, San Antonio's development languished, its population growth severely diminished by the events of history and the difficulty of life on the frontier. Conditions favored an influx of Germans to the city during the years preceding the Civil War. The complications and failures of the *Adelsverein* encouraged many Germans (precisely those who were not suited to farming or life in rural New Braunfels or Comfort) to migrate to San Antonio, where they might carry on their trade as craftspersons or professionals. Many German wagon makers responded to the need for transport not only from the coastal harbors but also into the interior of what became known as South and West Texas. Lively commerce with Mexico and the border cities of Eagle Pass, Laredo, and to some degree Brownsville brought wealth that only increased with the Civil War, whose trade routes established an outlet for the cotton exports of the entire South.

As the population of San Antonio increased modestly, German stonemasons contributed their skills to the growth of the city. German surveyors and architects helped to construct edifices, many of which today are no longer standing. Germans brought organizations with them, doctors and pharmacists, a thirst for free education, German-language newspapers, literature, and the arts. Visitors to San Antonio may discover its German-Texan foundations with little effort. Many of the landmarks represent second-generation affluence, when wagon makers and freighters became bankers and merchants. An inventory of a few of the architectural vestiges of a once-thriving German-Texan commercial life of central San Antonio follows.

- *Turnverein Turnhalle*, 411 Bonham Street (1891). The leading social and cultural organization of its day, the Turners advocated the "four Fs": *frisch, fromm, fröhlich, frei* (refreshed, pious, happy, and free) in a design visible on the cornerstone of the building. The architect, James Wahrenberger (1855-1929), was a native Texan educated in Germany.

- *The Menger Hotel*, 204 Alamo Plaza (1859), extensively remodeled. William Menger built his hotel for an extended list of raucous as well as distinguished guests. His establishment also housed a brewery, possibly the first in Texas.

- *Reuter Building*, 217 Alamo Plaza (1891). Architect James Wahrenberger also designed this ornate building for William Reuter to be used as a popular saloon.

- *Schroeder-Yturri House*, 1040 East Commerce Street (ca. 1870). This one-story, stuccoed-limestone house was built for George Schroeder, who lived here until 1910. Its design is typical of German-Texan residences: symmetrical, of stone, and equipped with a porch and a metal roof.

- *St. Joseph's Catholic Church*, 623 East Commerce Street (1876). The Germans wanted a church in their own neighborhood with services in their native language. The cornerstone is inscribed in German, as are the stained-glass windows of the interior. It is completely surrounded on three sides today by a well-known department store.

- *Joske's Department Store* (now Dillard's), 100 Alamo Plaza (1939). Julius Joske founded this prosperous business in 1868, though originally housed at a different location.

- *Staacke Brothers Building*, 309 East Commerce (1894). Brothers August, Rudolph, and Herman Staacke operated their carriage business from this structure. They are credited with bringing the first automobile to San Antonio in 1905 (Carson and McDonald 1986). The building is a splendid model of downtown restoration.

- *Casino Club Building*, 102 West Crockett (1926-28). The Casino Club, organized by Gustav Theisen, first met in 1857. Its charter subscribes to social purposes and the encouragement of literary pursuits. At one time, it was the only theater in San Antonio. It was a favored location for German-Texans to meet at the bar, read, play cards, and hold discussions. Now an apartment house, it stands under the protection of the National Register of Historic Places.

- *Old Lone Star Brewery*, 110 West Jones Avenue (1904). German-Texan architects Wahrenberger and Beckmann were the local supervising architects for this impressive structure, now the San Antonio Museum of Art.

- *Schultze's Store*, 300 HemisFair Plaza (1891). This building was the original hardware store of Hermann Schultze.

- *Old German-English School*, 419 South Alamo (1859). Founded by German intellectuals and built of limestone rubble walls, the complex now serves as a part of the adjoining hotel.

- *Staffel/Elmendorf/Tyler House*, 555 South Alamo (ca. 1850). These German merchants adapted their building experience to new climatic requirements: the houses display the Texan central hall and porches. They are integrated with the grounds of the adjoining hotel.

- *King William District*. Not far from the central downtown district of San Antonio is this city's most famous residential neighborhood, named for Wilhelm I of Prussia and often called "Sauerkraut Bend," because so many wealthy German merchants, professionals, and bankers lived here after 1860. It was planned by Ernst Altgelt, with three parallel streets, five blocks long, running along the San Antonio River. Some of the residences are open to the public. The *Wulff House* (1870), at 107 King William Street, is now the headquarters of the San Antonio Conservation Society. The *Steves Homestead* (1876), at 109 King William Street, was built by lumberman Eduard Steves of Barmen, Germany, and his wife, Johanne Klöpper, whose family had settled in New Braunfels in 1853. At the end of King William Street is the *Guenther House* (1859), at 129 East Guenther, standing modestly in front of Carl Hilmar Guenther's mill, now the Pioneer Flour Mill, one of the oldest businesses in San Antonio and still in the Guenther family.

The Future

The future of the German-Texans as a distinctive ethnic group does not look promising. Like all folk-groups, the German-Texans maintain themselves best in small towns and in the country; but Texas's population is becoming increasingly metropolitan.[1] It is now the second-most populated state after California and surpassed New York, which now ranks third. This population explosion is felt most of all in its German Belt.

Today, the German language has all but disappeared; it is spoken at home only by older people. Children choose to study Spanish. Fortunately, newer migrants continue to arrive from Germany, new firms with branch offices in both countries are being established, and exchange programs and sister-city cooperations are flourishing.

In general immigrants quickly begin to conform to patterns already established in their new homeland, even while they preserve some of their distinctive features brought along from the old homeland as they knew them at the time of their departure. Yet, the basis of these distinctive features exists only in memory and in the vanished past. This tripartite process is manifested by an 1840 two-dollar bill from the Republic of Texas (Figure 7.3). Looking closely at the cowboy depicted on it, one notices he is wearing a Tirolean hat and *Kniehose* (knee britches)—a German riding a horse alongside Texan longhorns. Modern Texas has clearly become something different through its contact with Germany. Germans have changed Texas; we cannot know what it might have been without them. The one would be unthinkable without the other.

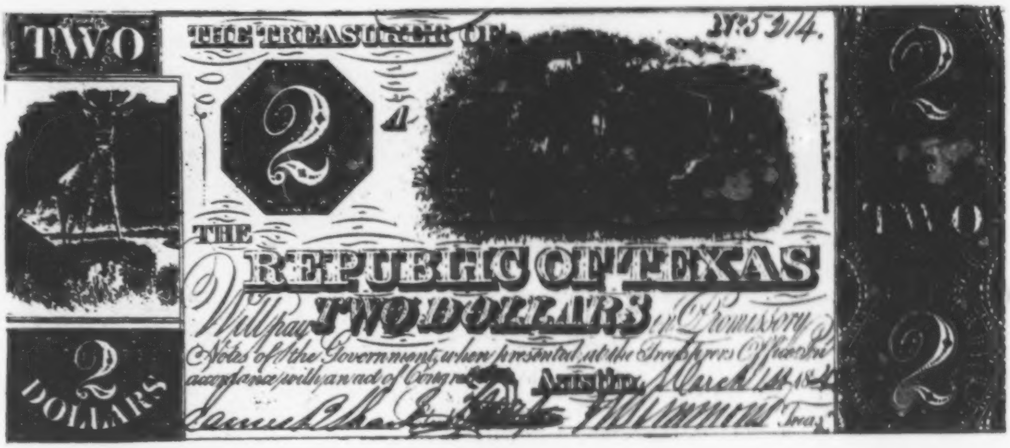

Figure 7.3: Republic of Texas Two-Dollar Bill
Note the Germanic attire of the horseman in the prominent illustration, top right of bill.
Source: Baxter Lane Company.

Note

[1] People living in metropolitan areas in the United States increased from 76.7 percent in 1970 to 79.7 in 1992. In Texas it increased between these two periods from 77.8 to 83.9.

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Relocation Diffusion and the Cultural Attributes of Afro-Texans

8

William R. Brown

Long before Moses Austin and his son Stephen immigrated to Texas, blacks were subsisting on the Texas plain. The 1792 Spanish census of Texas lists 263 black males and 186 black females among a total population of 1,600 (Katz 1987). They were free men and women who had Spanish surnames and spoke fluent Spanish.

The migration of blacks to Texas resulted from the Spaniards' failed attempts to enslave Native Americans. In 1517, Bishop Bartolome de Las Casas proposed and later promoted importing Africans, to relieve Native Americans of the burden and hardships that accompanied slavery (Franklin and Moss 1988).

De las Casas lived to regret this position and later advocated, unsuccessfully, abolishing importation of Africans. As a result of his earlier stance, the African slave trade had become a huge and profitable undertaking. Between 1451 and 1865, an estimated nine-and-a-half million African slaves were imported into the New World (Franklin and Moss 1988).

Involuntary Migration and the Institution of Slavery

The first African Texan, according to historical chronicles, was Estevan, the servant of the Spanish explorer Andres Dorantes. Estevan was born in Morocco around the end of the fifteenth century, and he has also been referred to as Estevanico, Stephen Dorantes, or Esteban (Katz 1987). Estevan and his master boarded a ship in 1527, as part of a five-hundred-man expedition authorized by King Ferdinand to explore the northern shore of the Gulf of Mexico. Although it was likely that other Africans were among the expedition's members, Estevan was to become a pioneer in influencing the lives of both the indigenous population and the European explorers.

After landing in Florida in April of 1528, the expedition encountered a great number of natural and social obstacles that sharply reduced their numbers (Kingston 1991). The survivors decided to construct five wooden rafts and sail to Spanish settlements in Mexico (Frantz 1984). As they neared the coast of Texas, a devastating storm destroyed all the rafts and left the four survivors, including Estevan, as captives among the local native tribes (Pelz 1990). After escaping from enslavement, the four found themselves in the midst of the Texas plain with no provisions or directions. They employed knowledge acquired during their captivity for survival, and Estevan began to display a special talent not only for survival, but also in mastering the native languages. As the expedition headed west, Estevan aided the Spaniards in acquiring a geographical knowledge-base about a land that only the natives had ever seen.

After an arduous trek of more than a thousand miles (sixteen hundred kilometers), the survivors finally reached a group of Spanish soldiers (in what today is Sonora, Mexico) in March of 1536 (Pelz 1990). Estevan was later to become such a successful explorer that in 1539 Father Marcos de Niza selected him to guide de Niza's ill-fated expedition to Cibola, or "The Seven Cities of Gold." Estevan was among the first explorers to visit territory that would become the western United States.

The slaves who were later to arrive in the United States (and eventually Texas) came from a three-thousand-mile (forty-eight hundred kilometer) stretch of area along the west coast of Africa (Bennett 1993). Many were captured during tribal wars and sold to European merchants, whereas others were enslaved for violation of African laws. Some of these captives were forced to march naked up to five hundred miles (eight hundred kilometers) from the interior to the coast while being chained two by two, left leg to right leg. The captives represented various African racial stocks and tribes, from "the spirited Hausas, the gentle Mandingos, the creative Yorubas, from the Ibos, Efiks, and Krus, from the proud Fantins, the courageous Ashantis, the shrewd Dahomeans, the Binis and the Senegalese" (Bennett 1993, 46).

Once the captives arrived at the coast, their captors placed them into holding pens, where they were examined to document their physical conditions prior to the trans-Atlantic voyage. The slaves were then branded with the identification marks of their future masters. The voyage from the west coast of Africa to the New World has been referred to as the "Middle Passage" (Figure 8.1).

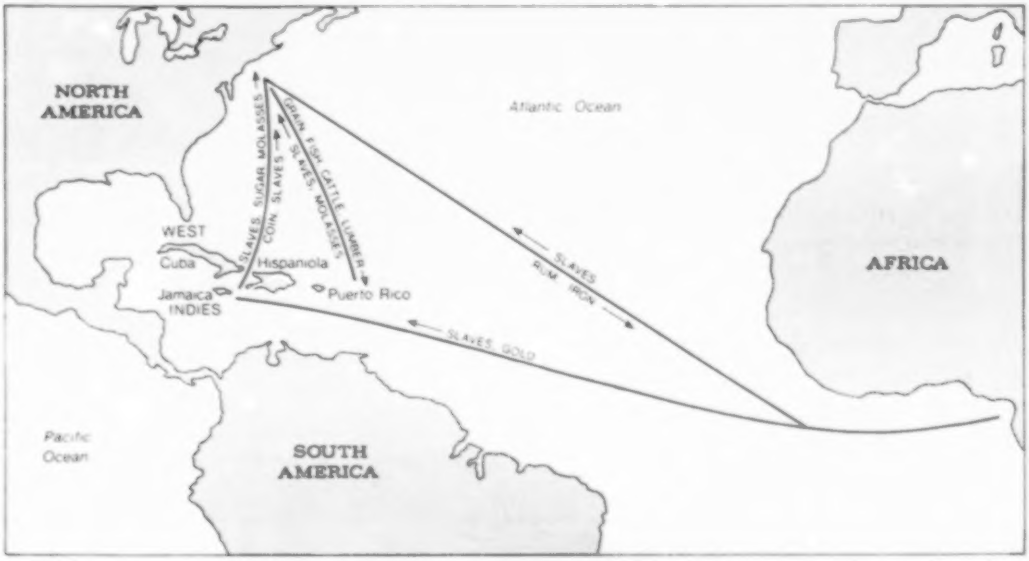

Figure 8.1: The Atlantic Slave Trade
Source: Modified from Weinstien, Allen and Gatell, Frank Otto. 1981.

Overcrowding on ships was a common practice among slave traders, and, some records reveal that ships as small as ninety tons (eighty-two metric tonnes) were carrying a cargo of 390 slaves along with provisions and the crew (Franklin and Moss 1988). The horribly crowded conditions increased greatly the incidence of disease. Malnutrition and hunger also adversely affected the health and survival of the slaves. Most of them were fed gruel (a thin cornmeal porridge) once a day. The diet could change to include beans, once used as a ballast for maritime vessels. If the slaves organized hunger strikes, a speculum was used to pry open the mouths of slaves and induce force-feeding (Jones 1991).

The mortality rate was such that not more than half the slaves survived the voyage. Those who did not succumb to disease or hunger died either by committing suicide or jumping overboard into the shark-infested waters. Many others were maimed as a result of unsuccessful struggles against their chains. After arrival in the West Indies, the slaves who managed to survive the dreaded Middle Passage would undergo a conditioning process that Jones (1991, 3) referred to as "seasoning." This process would prepare the slaves for the type of labor and lifestyle they would expect in the Americas.

Slavery began playing a major role in Texas in the 1820s, while it was a territorial possession of Mexico and was being colonized by Americans. Many American immigrants were Southerners who found ways to get around Mexican laws that prohibited involuntary servitude. There were three types of early settlers who came to seek the agricultural resources of Texas: (1) yeoman farmers who, along with their families, cultivated small crops and in some cases either owned or hired fewer than ten slaves on a seasonal basis; (2) small planters who owned between ten and fifty slaves; and (3) plantation owners who employed several overseers, owned more than one plantation, and owned fifty or more slaves (Silverthorne 1986). The 1834 census of population reported that Texas had twenty-one thousand whites and two thousand slaves (Silverthorne 1986).

Although the Texas Revolution was not fought over the issue of involuntary servitude, it achieved independence from Mexico, while ensuring the continuance of slavery. Post-war Texans were farmers, but the vast majority did not own slaves. More than fifty percent of the state's slave holders owned five or fewer slaves, acted as their own overseers, and sometimes worked in the field beside them. The state's true planting class was small in comparison, numbering around two thousand families. Of these, only fifty-four families owned more than a hundred slaves each. These affluent families could rent out a hired field hand for between two and three hundred dollars per year (Fehrenbach 1983).

The state's largest concentration of slaves was found on plantations of the lower Colorado and Brazos rivers (Figure 8.2). In Brazoria County and dispersed locations in East Texas, the slave population outnumbered whites (Hogan 1990). The state's population became predominantly white only at the Edwards Plateau line in Central Texas. Historians speculated that slavery would have extended to the Dallas–Sherman (north of Dallas) line if settlers had known that the area's black soils could produce as much "King Cotton" as the coastal muck (Fehrenbach 1983).

Importing slaves from Africa or the West Indies was illegal during the peak of the plantation system. The state received a steady supply of slaves from the more northern Southern states, which were eliminating the plantation economy (Fehrenbach 1983). Permanent slave-mart and slave-auction companies in New Orleans, Shreveport, Houston, and Galveston assisted in the sale and distribution of slaves. Auction companies and a slave mart in New Orleans and Shreveport supplied planters residing in East Texas (Silverthorne 1986).

The Southern Plantation System

The slave hierarchy within the plantation system was based on the assignment of tasks according to ability (and possibly skin pigmentation, as well). The three levels within the state's plantation system were: house servants, craftspersons or skilled slaves, and field workers (Silverthorne 1986). House servants consisted of the mammy, butler, cooks, and coachmen. The servants were in all likelihood lighter in pigmentation than the field workers, and they may have been quartered in the "big house." The terminology used for lighter-skinned slaves was: mulatto (one-half black), quadroon (one-quarter black), and octoroon (one-eighth black).

Craftspersons or skilled slaves included gardeners, stockmen, blacksmiths, carpenters, weavers, and brick masons. Field workers were usually the darker-hued Negroes, supervised by the black driver or taskmaster. Slave housing consisted of small cabins clustered about a quarter-mile (one-half kilometer) from the master's home. Skilled slaves or craftspersons constructed the typical slave cabins of logs. These builders later parlayed their construction skills to many log houses built during Reconstruction and the post-depression period (Jordan 1978). The cabin usually consisted of one small room with a door opening to the front end, "shotgun style," and no back door. The cabins has no windows (or only small, shuttered windows without screens or glass panes on each side of the cabin), a hearth with a mud-and-stick chimney for cooking and heating, and a "Georgia Hoss"—a one-legged bed, constructed by fastening two poles together, attaching them where they joined a post, and pushed the free ends of those poles through the walls in the cabin's corner (Silverthorne 1986). If the slave family was large, they could construct bunk beds to accommodate the situation.

To keep the slaves under tight control, the state of Texas passed ordinances addressing slave conduct. In 1850, fifty-one percent of the state's officials were slave masters. A mixture of democracy and aristocracy dominated pre-Civil War Texas at a time when slave masters controlled the political system (Kingston 1991).

Reconstruction and the Cattle Industry

After the Civil War and emancipation, African Americans were eager to take their rightful place as American citizens. The U.S. was experiencing a great westward migration, and blacks soon were to discover that the West was a place where they could apply their skills and gain employment.

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Furthermore, a new kind of cowboy had been produced as a result of slavery. Slaves had acquired, on Southern plantations, the arts of riding, herding, roping, and branding. African Americans, however, had been introduced to these skills at a much earlier time. In Africa the ancestors of these slaves bred horses and domesticated cows, goats, sheep, dogs, and cats. The religion of these Africans emphasized a "common link between man, his environment, and the universe," thus providing them with a natural ease in dealing with animals and with nature (Miller 1991, xiii). Europeans did not fully comprehend this religious philosophy, but they prohibited the Africans from practicing it once they arrived in America. In spite of this prohibition, West African knowledge and skills with horses and cattle passed from one generation to the next.

Severe economic hardship after the Civil War compelled Texas ranchers to rush their cattle onto newly forged trails (Figure 8.2). These ranchers were desperately seeking people with the skills and ability to survive the long and arduous cattle drives north to Kansas and Nebraska. The Shawnee, Chisholm, and Goodnight-Loving trails were the three major cattle-drive routes. Cattle drives originated in South Texas and traveled north to the various stockyards located along railroads for shipment. Ex-slaves and black Civil War veterans seized upon the opportunity available in Texas, and upon their arrival the ranchers employed them immediately. The word "cowboy" took on a new meaning as more than eight thousand ex-slaves and soldiers headed west.

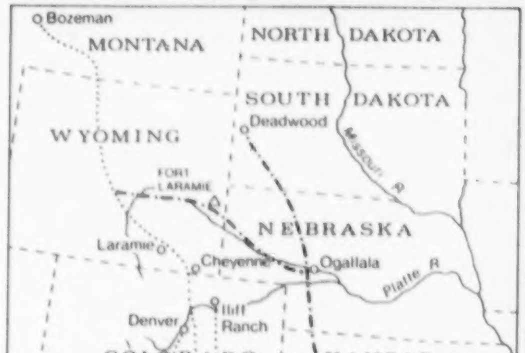

Figure 8.2: Major Cattle Trails
Source: After Durham, Philip and Everett L. Jones. 1983.

The Reconstruction period in Texas found all African Americans suffering to varying degrees from social, legal, and economic sanctions. African American cowboys, however, were less affected by these sanctions because of their occupation, which held a well-defined position in a previously established social hierarchy. The demands of their jobs enabled them to transcend much of the existing prejudice. On a cattle drive, a cowboy's ability to do his work, to handle his share and a little extra, was far more important than skin color. A wild longhorn had no more respect for a Caucasian cowboy than for an African American cowboy.

The African American cowboy was encouraged to be a hand, or even top hand, but he was rarely selected as a foreman (Durham and Jones 1983). An African American cowboy was similar to his cavalry brethren, who could attain trooper or even non-commissioned officer rank but was always commanded by European Americans. The African American cowboy, however, differed from the cavalryman in that on a ranch, in most instances, whites and blacks lived, ate, and worked in an integrated social environment.

Far more African Americans than Mexicans are likely to be mentioned in accounts of cattle drives. Even though Mexicans were exceptional *vaqueros,* they did not adapt themselves to the long drives as well as the African Americans. Yet, Mexicans suffered bigotry, experienced a language barrier, and were treated as despised foreigners in a strange land. African Americans, however, could rely on some support from Re-

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construction laws as well as from remnants of the old Abolitionist movement in Kansas, Nebraska, and other areas. Black cowboys could often find provisions in restaurants, saloons, and even whorehouses, because of the previous efforts of African American troops, whereas Mexicans were welcomed only at gambling tables.

On any given cattle drive, crews consisted of about eleven men: the trail boss, eight cowboys, a wrangler, and a cook. The trail boss, who was usually European American, was responsible for "making all of the decisions, controlling the speed of the herd, going ahead to find safe bed ground, calculating distances between watering places and anticipating hazards" (Durham and Jones 1983, 37).

The cowboys emphasized teamwork, and crews usually included two or three African Americans. Usually, two cowboys rode "on point," riding near the lead cattle to head them in the right direction and to slow or halt them when necessary. Four more rode "on swing," two patrolling on each side of the herd to keep it strung out and to keep cattle from straying too far off the trail. The last two cowboys, riding "on drag," stayed with the stragglers at the rear and ate the dust of the herd (Durham and Jones 1983).

The cowboys' duties were also based upon the type of cattle they drove. The most common type was the "beef herd," which was comprised of all steers. This kind of herd traveled swiftly, sometimes up to fifteen miles (twenty-four kilometers) daily, but no trail bosses wanted to drive their cattle at such a brisk pace that they would suffer weight loss. The other type was called a "wetherd," which consisted entirely of cows and traveled more slowly. On short drives one cowboy was designated to drive a calf wagon to carry the newborns, and later at night they would release the calves so that they could join their mothers (Durham and Jones 1983).

The wrangler, usually a boy, occupied the lowest position on the trail's social hierarchy. The wrangler was always up before sunrise, tending and driving horses all day until the final night herder cut his horse from the herd and the other horses had been hobbled. The wrangler was also expected to cut wood or collect chips for the fire and assist the cook in loading and unloading the chuck wagon, along with dish-washing obligations. Thus, the wrangler was strongly motivated to become a cowboy as soon as possible, if only to escape the sometimes tyrannical cook.

The cooks were usually African American or Mexican and were the oldest men in the outfit. In most cases they were former cowboys who no longer could withstand twelve to sixteen hours in the saddle. The cook was responsible for the outfit's food, bedrolls, and personal items stored in the chuck wagon. The cook also served as doctor, dentist, and older brother to the other cowboys.

The great trail drives ended because of overgrazing and fencing ranges, which later contributed to a great disaster in 1886–87. The cattle ranchers held thousands of cattle on overcrowded ranges. The summer of 1886 in the Dakotas, Montana, and Wyoming proved to be the hottest and driest on record, drying up water holes, parching the grass, and causing frequent range fires, which destroyed the best of the winter forage by the end of summer (Hamilton 1957).

The winter of 1886–87, brought the worst blizzard on record. The storm began in November with an early snow storm that dropped temperatures below 0° F (0° C), and much colder weather followed into December. By January, sixteen inches (forty-one centimeters) of snow had accumulated, and temperatures in Montana dropped to -45° F (-43° C). Some of the animals froze to death where they stood. Many other animals suffered lacerations on their noses and legs from the icy crust formed on top of the snow. Many of these helpless animals, which might have saved themselves by drifting with the wind, were stopped by barbed wire and perished. The next spring, as cowboys rode across areas of devastation, they discovered mounds of cattle carcasses along the fences. As one rancher surveyed the damage, he was heard to moan "that he had been ruined by the three G's—God, Government, and Grange" (Frink 1956, 57–58).

As the old trail drives drew to a close, the majority of the African American cowboys who rode out of Texas after the Civil War rode back after delivering herds. Very few of these cowboys remained in Wyoming, Colorado, or Arizona, and even fewer married or raised families there.

Conclusion

The term *relocation diffusion* is defined as the process by which an idea or innovation moves with an individual or group to a new location. A good number of slaves were well equipped for employment opportunities in Texas and the West during Reconstruction. With these marketable skills acquired on Southern plantations and earlier, in Africa, they were poised to saddle up and tackle the western frontier.

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The Border Industries Program: A Geography of Maquiladoras

9

Byron Augustin and Michal Kohout

One of the few bright spots in the Mexican economy today is the rapid development and success of the industrial expansion along the border with the United States. The Border Industries Program (BIP), now thirty years old, has stimulated economic growth in the otherwise underdeveloped border region. A half-million Mexican workers are employed in more than two thousand plants, and the industry generates roughly four billion dollars annually in foreign-exchange earnings (Uchitelle 1990).

History

The Border Industries Program began in 1965 because of rising unemployment in northern Mexico after the termination of the U.S. Bracero Program. The Bracero Program, developed as a response to U.S. farm-labor shortages during World War II, ended in 1964. To encourage construction of new industrial plants, the Mexican government made the following concessions under the BIP:

- Unlike other firms established in Mexico, the border assembly plants could be entirely foreign owned.
- The new industrial plants could import, duty free, machinery and other equipment, as well as parts and raw materials to be used in the production process.
- No taxes would be levied on the export of BIP-assembled items.
- Foreign managers and technicians would be allowed to work in these plants (Truett and Truett 1984).

Because of its high industrial wages, the U.S. was one of the first countries to be affected by the growth in global competition after World War II. To cut costs, U.S. industries divided their production processes and sought countries with inexpensive labor. As early as the 1950s, U.S. corporations began to export some of their more labor-intensive production stages to East Asia. Two important new U.S. tariff items, introduced in 1962 to facilitate the process of production division, would (1) allow the re-import of unfinished metal products for further processing in the U.S., and (2) permit assembly (value added) of finished goods imported to the U.S. for final assembly or consumption (the value of U.S. components is exempt). These tariff items offered incentives for U.S. industrial decentralization, because they encouraged the labor-intensive production processes, rather than entire industries, to leave the country.

The combination of the BIP and the tariff legislation appealed to U.S. investors, especially those in the border states like Texas. At the time, the border areas were relatively underdeveloped compared to the rest of the United States, and the BIP provided an opportunity to industrialize the region by means of twin plants. Under this concept, a factory on the U.S. side of the border would manufacture components in a capital-intensive operation, and it would then ship them to a labor-intensive assembly operation in a factory on the Mexican side known as a *maquiladora*. (This term comes from the Spanish *maquila,* which refers literally to the portion of grain a miller earns for grinding.) After assembly in Mexico, the product would be shipped back to the U.S. for domestic consumption or export.

Growth

The first maquiladora plant opened in 1965, and two years later, seventy-two plants employing nearly eighteen thousand workers were turning out assembled products for U.S. industries and consumers (Figure 9.1). The program grew steadily until the mid-1970s, when a recession in the U.S., coupled with an official minimum-wage increase in Mexico, resulted in some plant closings and employment cutbacks. When the U.S. economy recovered and the peso was devalued in 1976, maquiladora employment began to increase steadily (Hansen 1981).

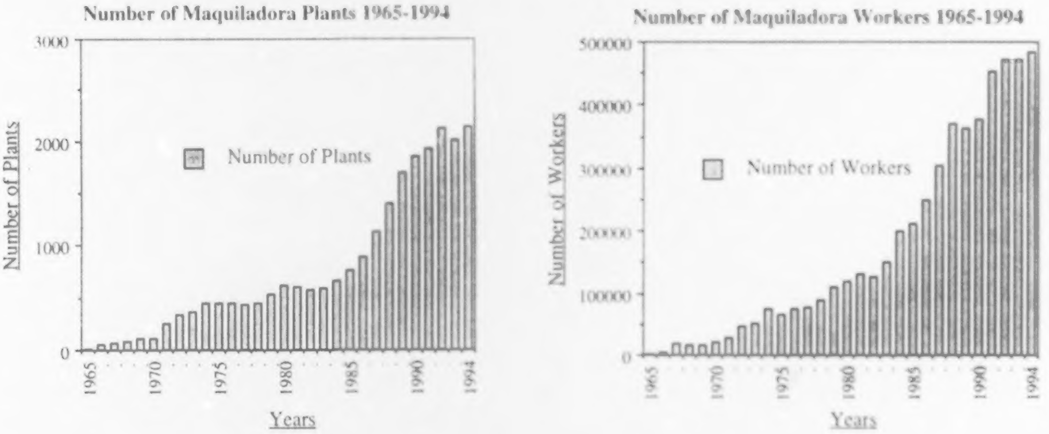

Figure 9.1: Growth Of The Maquiladora Industry, 1965-1994
Sources: South, R. B. 1990; Beaurnier, G. 1991; and, *Twin Plant News*, 1991, 1992, 1993, 1994, and 1995.

In 1982, a significant devaluation of the peso gave Mexico a distinct labor-cost advantage over its Asian and South American competitors (Table 9.1). Prior to the devaluation, average wages in the maquiladoras were seventeen percent of those in similar U.S. industries. Overnight, labor costs dropped to less than seven percent, causing the industry to grow rapidly.

Country	1981	1982	1983	1984	1985	1986	1987
Hong Kong	1.55	1.67	1.52	1.60	1.78	1.87	2.11
Korea	1.17	1.25	1.30	1.36	1.41	1.55	1.69
Taiwan	1.35	1.40	1.46	1.70	1.45	1.77	2.23
Brazil	1.90	2.16	1.46	1.23	1.28	n.a.	1.49
Mexico	1.36	1.69	0.71	0.76	0.88	0.60	0.84
U.S.A.	10.79	11.52	12.04	12.59	12.97	13.09	13.46

Table 9.1: Average Hourly Industrial Wages, 1981-1987 (U.S. Dollars)
Sources: Mirowski, P. and S. Helper. 1989.

Another key to maquiladora growth was Mexico's decision to join the General Agreement on Tariffs and Trade (GATT) in 1985. Before GATT, Mexico had held only limited appeal to U.S. investors because of restrictions and economic policies that severely constrained foreign investment. Mexico's entry into GATT allowed foreign investors (especially those from the U.S.) to diversify their investments in Mexico and reassured them about the security of their investments.

The low cost of labor and the Mexican government's new attitude toward foreign investment attracted not only U.S. companies but also Asian, European, and Canadian investors. Japanese companies led the Asian investments, concentrating in Tijuana, where almost 20 percent of maquiladoras involve Japanese firms. This foreign invasion is primarily to gain greater access to the U.S. market by using the same advantages of the BIP long reserved only for U.S. manufacturers. Using parts imported from the U.S., the foreign-owned maquiladoras assemble and re-export their products to the U.S. under the same tariff items as U.S. companies. This flood of foreign investment, along with increasing U.S. investment, bodes for continuing the rate of maquiladora growth.

Location

More than 90 percent of the maquiladoras are located in the six Mexican states bordering the United States (Figure 9.2). Most heavily concentrated in the four cities of Tijuana, Ciudad Juarez, Reynosa, and Matamoros, they account for almost half the plants and about 60 percent of the workers (Figure 9.3). The Mexican government originally controlled the locational distribution of the plants, hoping to alleviate the high unemployment rates along the border. In the beginning, the government authorized maquiladoras to operate only at ports of entry with customs facilities. In addition, the plants had to be established within twelve-and-a-half miles (twenty kilometers) of the border (Truett and Truett 1984).

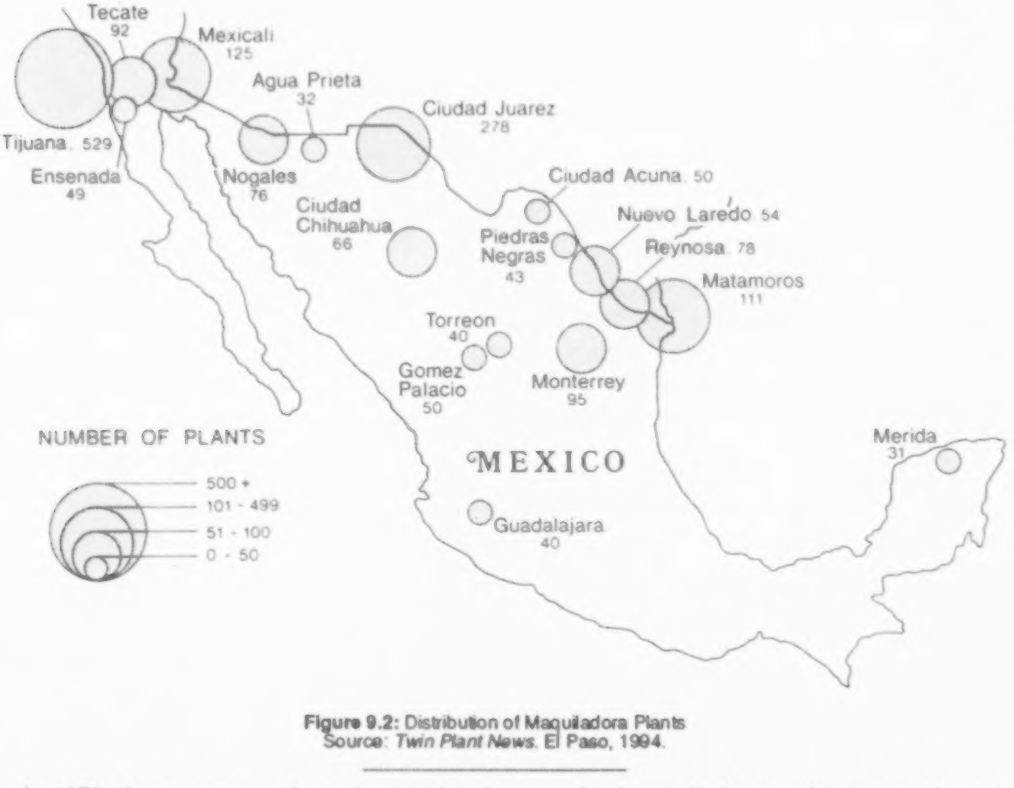

Figure 9.2: Distribution of Maquiladora Plants
Source: *Twin Plant News*. El Paso, 1994.

In 1972, the government issued new rules that permitted maquiladoras to locate anywhere in Mexico except for metropolitan Mexico City (Wilson 1986). By establishing Export Processing Zones (EPZs), the Mexican government sought to replicate the success of the frontier states in the interior. Consequently, maquiladoras now operate in Monterrey, Chihuahua, Guadalajara, Hermosillo, Durango, and as far south as Merida, capital city of the Yucatan.

The six Mexican states that share the approximately two-thousand-mile (thirty-two hundred kilometer) border with the U.S. have only 16 percent of the nation's population, but in 1988 they

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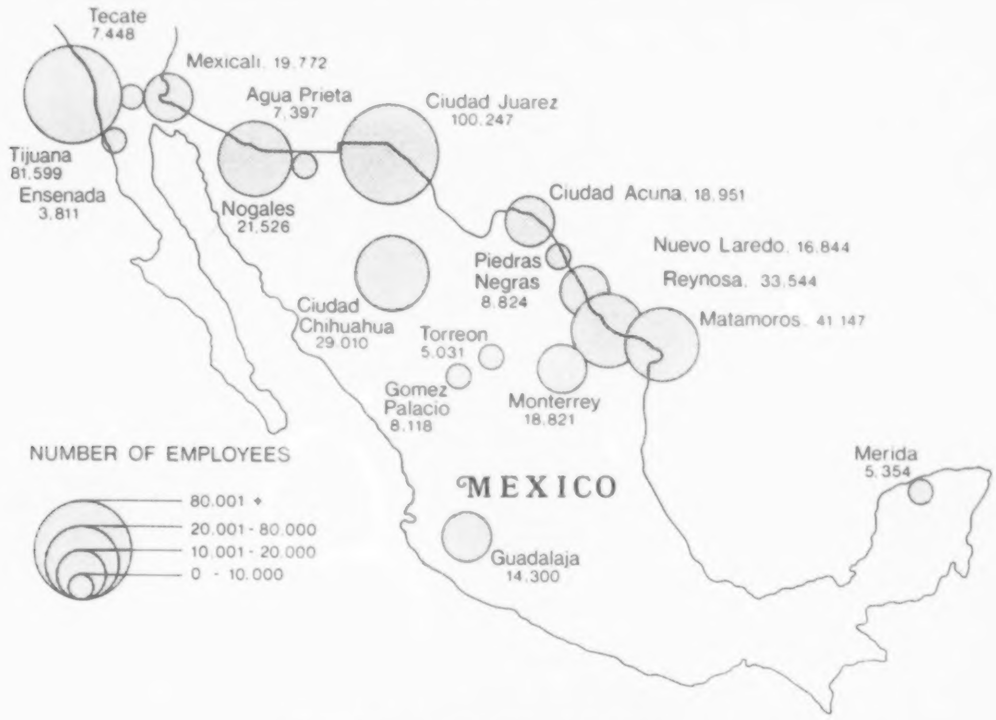

Figure 9.3: Distribution of Maquiladora Employees
Source: *Twin Plant News*, El Paso, 1994.

were generating 22 percent of the country's gross national product (GNP). Because of supply and distribution advantages, the concentration of maquiladoras will remain along the border even if decentralization occurs, albeit slowly, away from this zone. Transportation connections with U.S. border cities like San Diego, El Paso, and Laredo are excellent. Because the component parts shipped to Mexico for assembly are made primarily in the United States, the plants can cut costs because of their location near the source of their raw materials. Location along the border also places the finished product close to its market. This market advantage becomes increasingly pronounced as the U.S. population shifts to the Sunbelt states, particularly California, Texas, and Arizona. The border plants also offer American managers an opportunity to reside in the U.S., where their families can enjoy familiar American lifestyles and their children can attend U.S. schools (Conklin 1986).

Sectors of Production

The maquiladoras have undergone some changes in industrial structure since their inception. Industrial activity is characterized by labor-intensive processes that are no longer feasible in the U.S. at current wage rates. Electric and electronic products have accounted for the largest share of maquiladora firms and employment since the beginning of the program. Sorting, wiring, soldering, and assembly all demand labor-intensive processes. Television sets, computers, stereos, radios, hearing aids, appliances, generators—all are among the products of the maquiladoras. The market for electrical products in a U.S. society that has gone high-tech is seemingly unlimited. Both the civilian consumer-products market and the rapidly expanding government defense industry in California and Texas help make the border electronics industry thrive.

Japanese firms are especially active in the electronics sector. So many Japanese-owned maquiladoras build televisions that a recent report ranked Mexico as the third-largest exporter of TVs to the United States, behind only Taiwan and South Korea. The Japanese companies pro-

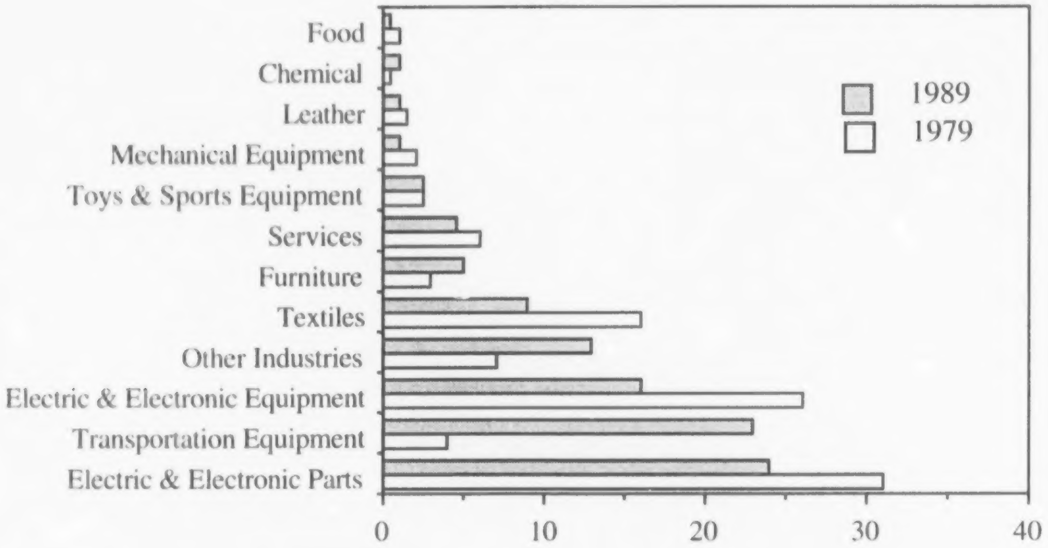

Figure 9.4: Percentage of Maquiladora Employees by Industrial Sector, 1979 and 1989
Source: Modified from Perry, D. M., W. H. Glaze, and M. Mazari. 1990.

mote this concept, because products assembled in Mexico and shipped to the United States from their plants count as Mexican rather than Japanese exports. This arrangement avoids the stigma of contributing to the worrisome U.S. trade deficit with Japan. Furthermore, the Mexican-made products are exempt from U.S. threats of trade sanctions (Eckhouse 1988).

In the maquiladoras, transportation-sector activity has moved into second place, replacing textiles (Figure 9.4). This change in rankings is largely attributable to efforts by the major U.S. automobile manufacturers to assemble an increasing number of such components as safety belts, seats, and windshield wipers in Mexico (Truett and Truett 1984). The Ford Motor Company and General Motors, for example, have moved many of their Asian operations to Mexico. This reduces a typical five-thousand-dollar transportation cost from South Korea to Los Angeles to only fifteen hundred dollars when the shipment originates in Tijuana, not to mention the savings in time.

Labor

No other aspect of the maquiladora program is as clouded with controversy as labor and employment issues. American labor unions claim that the maquiladoras steal U.S. jobs. Some U.S. immigration officials, however, claim that the program stems illegal migration to the U.S. by absorbing laborers before they cross the border. Other critics label the maquiladoras as sweatshops with unfair wage compensations. Mexican maquiladora workers are also accused of low productivity and poor-quality work.

Many experts now believe that the maquiladoras create U.S. jobs rather than supplant them. Hansen (1981) stresses that maquiladoras use more than ninety percent U.S.-produced components, raw materials, and machinery. In addition, lower labor costs in Mexico allow U.S. manufacturers to stay active in industrial sectors that might be lost to Asian competitors if they paid higher wages. Maquiladora workers create additional jobs, especially in border communities, by spending forty to sixty percent of their earnings in the U.S. Finally, the maquiladora program has created many employment opportunities for workers in the U.S. facilities of the twin plants.

Little evidence is available to substantiate the claim that maquiladoras have helped stem the flow of illegal immigrants into the United States (Hansen 1981; Wilson 1986). Traditionally, the maquiladoras have employed mostly young female workers. Most undocumented migrants who slip illegally across the border are young and middle-aged men from cities farther south in Mexico, or they are farm workers from rural districts with long traditions of migration (*The Economist* 1987). Initially a pull factor brings migrants to northern Mexico, but since many will not be able to find work, a subsequent push factor causes a migration spillover into the United States (Davila and Saenz 1990).

The modern industrial plants housing maquiladoras can hardly be classed as sweatshops. Most of the buildings are less than ten years old. They are well lighted, air conditioned, clean, provided with security, restroom facilities, cafeterias, and, on occasion, recreational areas. The electronics industry in particular demands an environment that is clean as well as humidity- and temperature- controlled (Russell 1984).

Although wages paid in maquiladoras are low by U.S. standards, they are competitive in the Mexican labor market. The maquiladora worker is neither the best-paid nor the worst-paid worker in Mexico (Salinas 1987). Wages are below the average wage of industrial workers in Mexico City, but so is the cost of living. Wages average ten to twelve percent higher than in Mexico's interior cities (Hewitt Associates 1988). Although less than half of Mexico's work force receives less than the minimum wage (Larmer 1987), maquiladora workers receive five to thirty percent above the minimum wage (Rivera-Batiz 1986). The Mexican government exerts pressure on the maquiladoras to keep wages down and consistent with minimum-wage standards in an attempt to control the national wage-price inflationary spiral.

Maquiladora workers have established excellent productivity records. Productivity in many plants is ten to fifteen percent higher in Mexico than in comparable U.S. plants. Absentee rates are also lower, averaging only two to four percent, as compared to five to nine percent in the United States (Russell 1984). Quality control is relatively high, partly because of the low cost of labor. Maquiladora plant managers hire additional inspectors for processing both incoming and outgoing shipments, as well as on-line quality-control inspectors (Thyfault 1987).

Young, single women predominantly compose the maquiladora work force, with the vast majority born in the border area. During the initial stages of development, female employment accounted for nearly ninety percent of all maquiladora employees. The maquiladora managers preferred young women, because they believed them to be more dexterous and easier to manage than young men. This female-dominated employment pattern gradually changed, so that by the end of 1988, it was estimated that men made up almost one-third of the maquiladora labor force (Hewitt Associates 1988).

For many workers entering the maquiladora work force, this is their first job. Most possess no more than a sixth-grade education and are unskilled laborers attempting to make a difficult transition to a modern industrial world. In a country where more than a million new workers enter the job market each year, the maquiladoras have provided employment opportunities for almost half a million workers who might otherwise be unemployed.

A major problem in the maquiladora labor sector is turnover. Some of it is caused by people whose primary goal is to emigrate to the U.S: and who use a maquiladora job to make enough money to fulfill that goal. According to Luckner and Alvarez (1985), other common reasons cited for the high turnover rates are:

- boredom with tedious assembly-line tasks;
- dislike of long hours away from home and families (the average work week is 48 hours);
- getting married, and husbands not allowing wives to work; and
- pregnancy.

The low wages paid in the factories give workers no real incentive to stay in one place. Instead, workers usually try many factories, looking for the right job for themselves. By recycling workers in this manner, the maquiladoras create their own labor pool (Grunwald 1985), one that is highly driven by preferences. All maquiladoras pay comparable wages, and the workers will seek a plant where the non wage benefits are the best. These benefits can include such things as transportation to and from work, subsidized meals, cash incentives for work longevity and accident-free days, and other perquisites.

Some companies have managed to curb the turnover problem. Rogers Corporation, a U.S. electronics firm, has cut its turnover rate to nine percent annually, from an already low 20 percent (Miller 1992). Its innovative approach hinged on worker-customer interaction, whereby the workers were divided into customer-focused teams, given greater individual autonomy, and trained to perform highly skilled tasks.

Labor unions play a minimal role in the maquiladoras, because their strength is limited by the Mexican government. There is a distinct geographical pattern of union influence in northern Mexico. The industrial northeast, ranging from Matamoros to Ciudad Juarez, is heavily unionized. On average, seventy percent of the maquiladora workers are members of a union (Williams and Passe-Smith 1992). In the northwest, union participation averages only twenty percent in Tijuana, Nogales, Agua Prieta, Ciudad Chihuahua, and Mexicali. Although Mexican unionization has been frowned upon by U.S. manufacturers, it has actually helped them, especially with labor turnover. By standardizing the levels of benefits in the maquiladoras, the unions decrease the differences between individual factories, thereby negating the incentive for laborers to move from one plant to another.

Economic and Social Consequences for Mexico

The most significant consequence of the maquiladoras in Mexico has been their critical role in providing a source of foreign exchange for a country with a massive foreign debt. The maquiladora industry recently surpassed tourism as Mexico's second-largest earner of foreign exchange, after the petroleum industry (Echeverri-Carroll 1988). The industry has also helped in the efforts to decentralize the strong focus of industrialization in the Mexico City area. Industrial decentralization is a priority of the Mexican government as it tries to cope with the problems of overpopulation in the Central Valley of Mexico.

Critics of the maquiladora industry cite few linkages between the industry and the mainstream Mexican economy. The BIP, however, has introduced new and modernized technology into the Mexican industrial scene. In the beginning, this was true only in the maquiladoras, but after 1985 (when Mexico joined GATT) the rest of Mexican industry was gradually affected. This new trade status bolstered the status of Mexican suppliers and established linkages between various sectors in Mexican manufacturing and the maquiladoras.

Management and specialized skills have also improved significantly among Mexican maquiladora employees, as the trend in the industry to employ Mexican managers and specialists continues. Several technical schools and universities have sprung up in the border cities in response to this trend. Mexican engineers, technicians, and managers can now improve their skills and advance to high levels within their companies.

Labor and environmental groups in the United States have voiced additional concerns. They are raising questions about social and environmental problems by those responsible for dealing with the effects of the rapid growth of the maquiladora industry. These questions include:

- What are the sociological stresses associated with industries that employ mostly young women, leaving much of the male population idle?

- How does a working wife or daughter affect the traditional family structure in a male-dominated society?

- How will cities with explosive population-growth rates maintain city services such as housing, schools, transportation, electricity, water supply, solid waste disposal, and health care?

- Are companies complying with environmental laws in Mexico, and what long-range effects will the plants have on air and water pollution? Are they threatening the health of the border region's citizens with improper toxic-substance disposal?

These questions and many others remain to be answered. New research on environmental effects of maquiladoras is especially critical.

Economic and Social Consequences for the United States

The general consensus in the United States is that the maquiladoras have had a very positive effect on industries north of the border. Strong evidence demonstrates that the program creates many new jobs for U.S. workers. Since a large percentage of the components assembled in Mexico originate in U.S. factories, these U.S. jobs are protected by the success of the program. The rapid entrance of Japanese companies into the Mexican Border Industries Program is not causing widespread concern in the U.S. Many analysts believe that the Japanese firms will actively seek U.S. components in their factories to cut transportation costs and to take advantage of the tariff laws.

The program is also creating new jobs in U.S. border towns, which have been plagued by high rates of unemployment and a high incidence of poverty. In El Paso, the Bermudez Industrial Group estimated that more than one thousand management and technical personnel live in the city but work in Mexican maquiladoras in Ciudad Juarez. The *Texas Business Review* estimated that "the maquiladoras contributed one in five new jobs created in El Paso in the past two years" (Echeverri-Carroll 1988, 5). The problem with these jobs is that they are not the type of employment desired by the U.S. border communities. Under the twin-plant theory, the jobs promised to border communities were high-tech, high-paying manufacturing jobs; however, the greatest job-sector growth is in low-paying retail sales.

Most industry leaders point to the lower labor costs in Mexico as the biggest advantage of the Border Industries Program. Inexpensive labor allows them to market their finished products at competitive prices with their Asian counterparts. Since the United States is the major market source for these products, the American consumer benefits from the lower prices, which keep down the cost of living.

Finally, the U.S. border cities, such as San Diego, El Paso, Laredo, and Brownsville, receive a substantial economic boost when Mexican workers cross the border to spend forty to sixty percent of their wages in U.S. retail outlets. The significance of those spending habits was highlighted after the 1982 peso devaluation curbed Mexican spending and sent the U.S. border towns reeling in a downward economic spiral.

Future Prospects under NAFTA

Under the North American Free Trade Agreement (NAFTA), barriers to trade will be progressively removed, ultimately allowing a free flow of goods between Canada, the United States, and Mexico. The process of removing trade barriers will take approximately fifteen years, during which time protectionism is actually expected to increase as each country tries to reinforce chosen economic sectors (Laredo Development Foundation 1992).

These changes will not have much effect on the BIP, however, which has operated relatively unchanged for thirty years, under varying tariff conditions. With the tariffs removed, the flow of trade should increase and become more efficient, and conditions will closely resemble the current trade under the BIP. NAFTA will therefore only formalize what already exists.

Conclusion

Mexico has benefited from the Border Industries Program, which has provided it with technology, know-how, and almost half a million jobs. Low-cost and mostly labor-intensive operations in Mexico, tied to capital-intensive industry in the United States, have forged a new urban-industrial complex along the frontier of these North American neighbors. This complex does not exactly correspond to the initial *twin plant* concept as originally intended. What has happened, however, is that instead of manufacturing plants on the U.S. side, in general, there are only warehouses.

The Border Industries Program has saved jobs in the United States, because manufacturing firms moved only some of their production processes to Mexico instead of moving the entire operation (as they had done in the 1950s when off-shore manufacturing began in East Asia). In Mexico, the maquiladoras have contributed to regional development by being allowed into the interior. U.S. firms have thus transferred expertise and technology to Mexico, and they are now contributing to development and diversification of the Mexican manufacturing sector.

Resource-management problems and environmental costs are prominent factors that could hurt the Border Industries Program and must be addressed promptly. Ninety-nine percent of the waste generated by U.S.-owned maquiladoras is not being shipped back to the United States, contrary to the terms of the original BIP agreement. Water shortages, as well as pollution, are serious problems that agencies of the Mexican government have yet to tackle. These and other issues can be dealt with under the North American Free Trade Agreement, which will establish ownership rights but will not change the overall scope of the maquiladora industry. If the political situation in Mexico remains stable and the value of the peso stays low, then the future of the BIP remains a bright one.

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Environmental Hazards of the Lower Rio Grande Valley

10

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In 1993, the governments of the United States, Canada, and Mexico ratified the North American Free Trade Agreement (NAFTA). This heavily debated treaty was seen as an antidote to socioeconomic problems on both sides of both U.S. borders and was sold with promises of wealth, prosperity, and health to many different groups of people. One region that was expected either to gain great benefits (in the form of employment and business) or suffer great ills (in environmental destruction or intensified poverty) is the Lower Rio Grande Valley.

Hazards of Place

We can examine the Lower Rio Grande Valley according to the distribution of *hazards* (events that pose environmental threats to human health). The simple occurrence of hazards, however, is not always the best measure of *risk* (probability of loss from a hazard). Risk and hazardousness depend upon not only the number and severity of events but also on efforts at mitigation (reducing hazard severity through planning and engineering) and the place-based characteristics of the residents who might experience a hazard. This population factor, *vulnerability,* is tied to socioeconomic characteristics that determine the response of residents to hazardous events. Some geographers who study these sorts of events follow a "hazards of place" approach, by considering the combination of risk and mitigation (together constituting the "vulnerability of place") and the consequences that result from human vulnerability (Cutter and Solecki 1989).

The underlying physical and human geographies of the Lower Rio Grande Valley demonstrate these concepts. This chapter will focus on three activities—agriculture, maquiladoras, and colonias—and describe their current and potential repercussions on the health and environments of the valley.

The Land and the People

The lower valley of the Rio Grande (known to Mexicans as Rio Bravo Del Norte, or simply Rio Bravo) includes four counties in South Texas and a narrow swath of land in the Mexican state of Tamaulipas (Figure 10.1). The region extends about 120 miles (193 kilometers) west to east, from west of Rio Grande City to the mouth of the river near Boca Chica. Despite its name, the valley is defined not strictly by the characteristics of its physical landscape, but by a cultural and environmental geography, where the population density and economic activities center on the Rio Grande.

To the north, the Lower Rio Grande Valley quickly disappears into the expansiveness of the King Ranch and Kenedy and Brooks counties. The change is most evident as crop agriculture is replaced by ranching, which has little connection to the activities along the Rio Grande. To the south, the valley is arbitrarily defined by Mexico's Highway 2 and the southerly municipal limits of Reynosa and Matamoros. Agricultural land use predominates to the south. Although sorghum and corn are the primary crops in northern Tamaulipas (much of the harvest from this area is used in food processing in Reynosa and Matamoros), farmers grow other grains and oil crops in the vicinity, including sugar cane, soy beans, wheat, safflower, cotton seed, and sunflower.

There is no true *valley*. This region is a fairly gently sloping floodplain (from about 520 feet, or 159 meters, in elevation at Roma-Los Saenz to sea level at Boca Chica). Flooding has changed the course of the river many times, leaving *resacas* (dry or wet cut-off oxbows of the river), that farmers have used for irrigation ditches. Physiographically, it is part of the Gulf Coastal Plain. The Hill Country of the Valley begins to the west of Rio Grande City. This area is somewhat higher in elevation and much more rolling topographically.

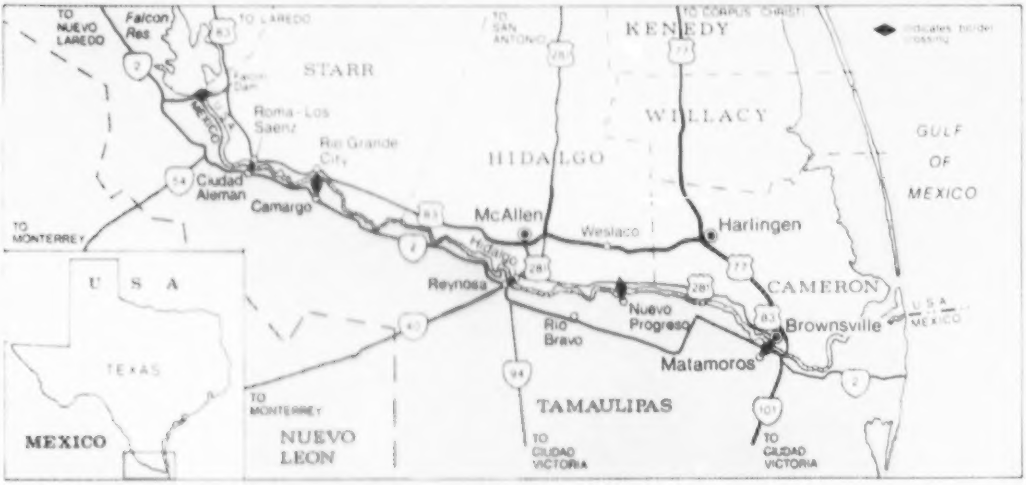

Figure 10.1: The Lower Rio Grande Valley

Annual precipitation here averages about 30 inches (76 centimeters). The 20 inch (51 centimeter) isohyet defines the western extent of the valley. In South Texas, this line marks the ecological transition to the Chihuahuan Desert, beginning near Falcon Reservoir. To the west, water is scarce, limiting agriculture to ranching.

The Lower Rio Grande Valley is the most productive agricultural region of Texas. All of the production of Texas citrus and more than 80 percent of the vegetables grown in Texas come from the valley (Douglis 1989). This productivity is possible (in part) by the amount of natural precipitation, but agricultural success also depends upon irrigation. Elaborate irrigation works were begun during the first decade of the 1900s. Irrigation has been combined with the subtropical climate (relatively warm year-round and only occasional freezes) to allow growers to replace the former vegetation (grasses, mesquite, and other South Texas scrub) with subtropical fruits, sugar cane, aloe vera, and many winter vegetables, including onions, cantaloupe, cabbage, bell peppers, honeydew melons, carrots, lettuce, broccoli, watermelon, cucumbers, spinach, tomatoes, potatoes, cauliflower, and sweet corn.

Spanish settlers from Mexico first inhabited the region in the middle of the eighteenth century. As they herded longhorn cattle, they overgrazed the grasslands and destroyed much of the unique subtropical palm-groves by the middle of the nineteenth century. The arrival of irrigated agriculture in the twentieth century replaced second-growth mesquite scrub with monocultural irrigated agriculture and urban development. This land conversion led to early environmental interest in the region, sparking efforts to create natural areas, wildlife refuges, and reserves along the river.

Loss of natural habitat has affected many native wildlife species, and many have already become extinct. Today, at least 110 species of plants and animals found in the valley are endangered, threatened, or on the "watch" list (Douglis 1989).

Irrigation has also threatened the productivity of the soil. Salinization of soils increased as the repeated soaking and evaporation of water diverted from the Rio Grande left behind dissolved minerals. Installing drainage fields allowed excess irrigation water to drain out of the soils and into drainage that returned flow, along with many of the dissolved minerals, to the river.

The Lower Rio Grande Valley has historically lagged behind both the U.S. and Mexico in economic development and growth. Matamoros was established as a Spanish mission site in 1700. Reynosa and Camargo were both founded in 1749 as Mexican villas. Later, border towns were added for other reasons; for example, Ciudad Miguel Alemán, originally named San Pedro, was established in 1921 as an agricultural colony. Despite the long history of settlement in the area, by 1900, none of these cities had populations greater than 8,350 (the population of Matamoros, the largest city at the time). Combined, their populations totaled less than 15,000. Today, Mexico's portion of the region's population exceeds three-quarters of a million residents: Matamoros has more than 300,000 residents; Reynosa, more than 281,000; and Rio Bravo, nearly 100,000. On the American side, the popuiation about equals that of *la frontera* (the other side of the river). The combined populations of Cameron, Willacy, Hidalgo, and Starr counties in 1990 was 701,888. The major cities of Brownsville, Harlingen, and McAllen accounted for about a third of this total.

Another key aspect of the population of this region is its growth rate. The residential population has exploded in the last forty years. The population on the Mexican side has tripled since 1960, and on the U.S. side, population has doubled in that time (Betts and Slottje 1994). From 1990 to 1992, the McAllen-Edinburg-Mission (Edinburg to the north and Mission to the west) metropolitan statistical area was the fourth-fastest growing area in the United States (after Las Vegas, Laredo, and Yuma) at a rate of 9.8 percent annually. Besides natural increase, three factors contributed to this population explosion, which has mainly resulted from migration from the south: American agriculture's demand for migrant labor; the border industrialization (BIP) program of 1965; and underpinning both of these, a fragile Mexican economy with widespread rural poverty.

Mexican migrant labor has been in demand in the United States for more than a century. In 1942, the U.S. government established the Bracero Program, a federally operated system of temporary, contracted Mexican labor for private agricultural production in the U.S. The program subsidized agricultural production by providing low-wage labor, and it was also used to monitor the Mexican immigrant stream to ensure that migrant laborers did not become illegal residents. This program ended in 1964, returning Mexican farm workers to an *unwelcome* status. Today, legal American residents predominate in the migrant work force in U.S. agriculture, but Mexicans and Central Americans still cross the border illegally to work. For this reason, some of the population increase in the Lower Rio Grande Valley can be attributed to the attraction of workers to the agricultural operations north of the border.

The Mexican government's response to cancellation of the Bracero Program was to agree to another plan that sanctioned the use of cheap Mexican labor in American industry. The Border Industrialization Program of 1965 allowed foreign-owned companies to locate subsidiary assembly plants in Mexico. Mexico guaranteed low overhead costs and required export taxes only on the value added to the products. The *maquiladora* (literally, a place where milling is done for a fee) was most often located immediately across the border to facilitate transportation of materials from the U.S. to Mexico and back again. Under this arrangement, Mexican workers would get jobs and American businesses would be able to produce their goods less expensively. Prospects of work in the maquiladoras and the relatively high wage rate (averaging about $1.90 per hour) have attracted poor and landless workers from urban and rural areas of northeastern Mexico.

Viewed from Mexico's interior, the valley holds a bright prospect of employment and survival. For many Mexicans, crossing the border evokes ideas similar to the Dust Bowl emigres' "Land of Milk and Honey" image of California during the 1930s, but getting there is only half the battle. In reality, the Lower Rio Grande Valley is America's "new Appalachia" (Gibney 1987). The land yields wealth for many, but that wealth escapes the creators and harvesters of that wealth, leaving behind vulnerability and risk in one of the poorest parts of the United States.

In 1990, median family income in the Lower Rio Grande Valley was about half of the Texas and U.S. levels. Wage earners in Cameron, Hidalgo, and Willacy counties averaged between 40 and 49 percent of the U.S. figure. Starr County, by far the poorest of the four valley counties, had a per-capita income of only $4,152—a mere 29 of the national per-capita income. Nearly 300,000 people, or about half of the population in these four counties, were living on incomes below the poverty line in 1990. In contrast, poor people in Texas amount to less than one-fifth of the state's population (Betts and Slottje 1994). Health care, education, transportation, and training are beyond the reach of many of the region's residents.

Across the border, poverty conditions are even worse. It is estimated that the poor compose more than fifty percent of the population in the border cities and nearby rural areas. Caused primarily by the historically weak Mexican economy, this poverty is exacerbated by environmental degradation along the border.

Environmental Hazards in the Valley

The collection of environmental hazards in the Lower Rio Grande Valley is found in few other locations in the world. One area where similar conditions are found is the California-Mexico border towns of the Imperial Valley. The U.S.-Mexico border has the steepest economic gradient in the world, which allows American companies to take advantage of Mexico's need for work. Agriculture and other low-wage industries in the Lower Rio Grande Valley have generated a unique set of environmental hazards.

Agricultural Hazards

Industrialized agriculture, as practiced in the Lower Rio Grande Valley, produces both prosperity and potential despair for the growers, workers, and residents. Problems derived from these activities result from both natural events and technology. Natural hazards are primarily atmospheric, including occasional floods, regional droughts, and hurricanes, all of which can have a severe toll on the crops. The most devastating weather-related hazard, however, that occurs here is the hard freeze. With some regularity (every five to eight years), the valley experiences blasts of Arctic air that push southward from the Great Plains, allowing sub-freezing temperatures to reach the Mexican border.

Agriculture in the valley is based on three kinds of crops: subtropical citrus fruits (grapefruit, oranges, limes, and lemons), winter vegetables (onions, melons, cabbage, and potatoes), and plants that grow year-round (such as aloe vera). Citrus trees, once mature, produce crops each year. A freeze, particularly early in the harvest, can destroy most or even all of an annual harvest. A very heavy frost can freeze sap in the trees and split branches to the extent of killing entire groves. In a single night, orchards can be completely destroyed. If insured, growers would be out of business for at least two years, until newly planted trees can begin producing fruit. Without crop and orchard insurance, however, citrus farmers are put out of business.

Winter vegetable crops are planted in the fall and harvested in the late winter months and on into spring. Freezing temperatures can kill any crop above ground, and if it becomes cold enough, vegetables growing below the surface can also be destroyed. The aloe vera, a succulent desert plant, contains a thick liquid gel used in manufacturing ointments and cosmetics. Freezing temperatures can kill the plant and freeze the plant's gel, rendering it worthless.

Freezes in the valley are most likely to occur during the first months of winter. The most recent devastating freezes have come in December. The last two, in 1983 and 1989, cost the valley's citrus businesses at least $450 million. The first freeze destroyed about forty-seven thousand of the seventy thousand acres (nineteen thousand of the twenty-eight thousand hectares) of grapefruit and orange trees that were producing in 1983. While growers were still rebuilding the orchards, the freeze in 1989 reduced production again to only sixteen thousand acres (sixty-five hundred hectares) (Williams 1992). In addition to the direct loss, an estimated twenty thousand picker, packer, maintenance, and trucking jobs never materialized. In a region where unemployment rates normally run from fifteen to twenty percent, the post-freeze unemployment rates soared to fifty-five percent in some areas. An already poor, underemployed population was made more vulnerable by this disaster.

Despite this destruction, the freezes had some positive effects on the citrus industry. Near-decimation of the crop increased the value of the remaining harvest. Those who could harvest anything after the freeze benefited from higher prices for their fruit.

Crops are important investments to growers, and they will do what they can to protect them and to ensure the greatest harvest possible. Growers in the valley, therefore, depends upon pesticides for production as much as growers in any American agricultural region.

Pesticides pose several risks to the workers and residents of the valley. Employment of migrant labor in agriculture most often focuses on picking and packing produce. This process exposes workers to residues of previously applied pesticides. Contact with the residues may not produce immediate problems, but accumulation and combination of chemicals in workers' bodies can cause problems to which they may eventually succumb.

Many reports indicate workers being exposed directly to pesticides by careless applicators while in the fields. Although most pesticide makers recommend specific waiting periods to delay contact with pesticides, growers and even the workers often ignore these guidelines. Whether aimed at crops upwind from workers or at the crops being harvested, pesticide spraying often causes workers to suffer debilitating health effects that they may neither, nor have the income to afford treatment. They often fear losing their jobs if they complain.

Pesticides are washed from the foliage and soil into groundwater and irrigation runoff, which flows not only into ditches but also (eventually) into the cooking pots and drinking cups of the residents of the valley. As the Rio Grande reaches the Valley, its waters are filled with a multitude of toxic pollutants from untreated sewage, industrial wastes, and agricultural runoff. Unfortunately described as an international sewer, the Rio Grande holds a legacy of being unswimmable, unfishable, and unsuitable for human and nonhuman use in areas up to about 100 miles (160 kilometers) downstream of cities like El Paso-Ciudad Juárez and Laredo-Nuevo Laredo, in addition to the cities of the Lower Rio Grande Valley.

Industrial Hazards

The maquiladora industries, despite their undeniable benefit to the border economy (two to three billion dollars annually, with a current growth rate of twenty percent), also have a reputation for bringing risk as well. Intentional and accidental dumping of toxic wastes and toxic materials have tarnished the image of these companies, implying environmental *escapism*—avoiding stricter environmental regulation in the United States. At least seven major chemical accidents occurred at maquiladoras in Matamoros and Reynosa between 1986 and 1991, causing more than 350 injuries and requiring the evacuation of several thousand residents.

Although the Border Industrialization Program (BIP) agreement requires that all hazardous wastes be returned to the U.S. for processing and disposal, costs ranging from $150 to $1,000 per fifty-five-gallon drum discourage proper disposal. Only small amounts of the waste are properly disposed in Mexico (the National Ecology Institute says it amounts to 0.001 percent). The chosen alternatives most plants use is either to stockpile, bury, dump, flush, or burn the wastes or even to *donate* the materials to charities for recycling. Only a small percentage of the waste generated returns to the U.S. in appropriate containers. A survey in 1988 found that only 11 of 400 U.S.-owned maquiladoras were abiding by the law. Some is never returned, and some is returned through environmental "channels," via groundwater and surface runoff (Satchell 1991; Garcia 1991).

By 1990, close to 200 assembly plants were operating along the border of Tamaulipas (including 93 in Matamoros, 57 in Reynosa, and 35 in Rio Bravo). Nearly 55 thousand workers were employed in industries ranging from electronics, machinery, and transportation equipment to chemicals, textiles, footwear, and leather goods. Wages are less than half the U.S. minimum wage, which clearly demonstrates the attractiveness of the border to American corporations (Betts and Slottje 1994). The challenge of survival at such wages is not based on a Mexican wage affordability (crossing the border does not drastically affect the price of staples). Most maquiladora workers live in shantytowns of wooden or concrete shacks with dirt floors, no heat, and few modern appliances.

Patterns of health problems have become symbols of industrial disregard for the welfare of the workers as in cases like the "Mallory children" and the virtual epidemic of neural-tube birth defects (more than 130 cases of anencephaly have been reported in rural Cameron County alone between 1980 and 1993, as well as numerous cases of spina bifida), *migratory* defects, and leukemia in northern Tamaulipas and South Texas. The Mallory case was settled out of court in January of 1995 for 15 million dollars. It involved claims by workers at a capacitor plant in Matamoros owned by R. R. Mallory, Co. (today a subsidiary of Kraft and Duracell) that miscarriages, stillbirths, and extensive physical and mental defects suffered by pregnant female employees and their children during the mid-1970s were the result of improper management and safeguard of toxic chemicals. At least 30 children and babies were identified as victims of exposure to PCBs in liquids used to wash capacitors. Twenty-five of the severely retarded children have now reached their teens, and some have experienced complications preventing normal passage into puberty (Satchell 1991).

Environmental activists and Mexican government inspectors have found maquiladoras to be violating Mexican environmental regulations. In Matamoros, for example, a fungicide manufacturer employing 40 people was recently shut down for a week and fined $2,500 for environmental "infractions" associated with fungicide dust and other chemicals in the air near the plant (Garcia 1993).

Industrialization, combined with agricultural activities and untreated human waste, predominantly from Mexican border cities and from poverty-stricken rural settlements in Texas, have earned the Rio Grande the number-one rank on a list of endangered rivers in the United States. American Rivers, an environmental organization, has declared the Rio Grande in the Brownsville-Matamoros area "a virtual cesspool" (Wright 1993). Heavy metals, pesticides, fecal coliform bacteria, and synthetic industrial chemicals may pose significant health risks. Near Reynosa, one tributary has "a high potential for toxic chemical impact," according to a multi-agency study of the Rio Grande Basin. It is among eight sites along the river (two in the main channel and six in tributaries) that appeared to be highly contaminated in the samples taken (Texas Parks & Wildlife 1994). Tests made in 1990 of water near a maquiladora in Matamoros contained some toxins at levels several thousand times the U.S. Environmental Protection Agency's safety standard (Nusser 1993c). The streams are the greatest threat to valley health, as the river yields both treated municipal water and untreated supplies to poorer residents not fortunate enough to be connected to public water systems. Residents of settlements outside of municipal boundaries derive their drinking, cooking, and cleaning water from groundwater pumps, irrigation ditches, agricultural drains, or even the main river itself.

Colonias

There is a housing crunch in the Lower Rio Grande Valley because of the population boom (growth rates as high as nine percent per year) that the valley is currently undergoing. The demand for housing is so great that vacancy rates are below one percent on the American side (Davies and Holz 1992). Affordable housing is relatively nonexistent for either native or immigrant working-poor in the Valley. To assist the working population in their quest for affordable housing, a system of exploitation has developed to make large amounts of money from widespread poverty. The result, enabled by a lack of county land-use control, is what are known locally as *colonias.*

Colonias are "unincorporated, quasi-rural settlements characterized by substandard housing and the absence of running water, wastewater facilities, garbage collection, and paved roads" (Davies and Holz 1992). More than 550 colonias are in the Lower Rio Grande Valley, and they are home to more than 120,000 residents. Nearly ninety-nine percent of the residents are Hispanic, and more than 60 percent were born in the United States (Betts and Slottje 1994).

With names like Sunny Sky Estates, El Dora, Amada Acres, and Valle Hermosa, one might imagine colonias to be attractive suburban subdivisions. However, colonias are rife with environmental hazards stemming from three basic sources: the internal infrastructure of colonias, their external environmental context, and the politics and land-use management policies of Texas.

A colonia begins with the sale of the American dream to hundreds of landless poor in the form of security through land ownership. After undeveloped agricultural land outside the boundaries of municipalities is subdivided legally in county offices (with the requirement of the provision of roads and drainage to subdivided property), developers attract buyers of lots with a promise to provide electricity, water and wastewater systems, and paved roads. The deals are irresistible, because sellers require very low down-payments and offer affordable plans to spread payments over lengthy periods. The hidden incentives for developers are high interest rates on a large volume of sales of small lots, usually between six thousand and eight thousand square feet (550 to 750 square meters) each. Sellers, who purchase the land at such low prices determined on the basis of agricultural land use, can subdivide and sell hundreds of plots for many times the original purchase price. Davies and Holz (1992), for example, report that in the case of Del Mar Heights (near San Benito in Cameron County), eighteen hundred plots were sold for between $1,000 and $2,500 each, bringing the owner, after interest rates and ten years of payments, between $1.8 and $4.5 million. Little, if any, of this profit is directed toward providing the services promised to colonia residents.

In 1989, the General Accounting Office reported that only 448 of the 552 colonias in the Lower Rio Grande Valley had water systems. These so-called systems ranged from wells dug by the residents, developer-provided wells, or corporation-provided water supplies. Water systems simply deliver water to the neighborhood. Most lack the pipes necessary to deliver the water to individual homes. The water that is delivered usually does not meet public health standards. Colonias without water systems acquire their water by hauling it from irrigation ditches, the river, or from a neighboring colonia. Often the water is contaminated at its source, but health is further jeopardized through the use of containers that might have contained hazardous chemicals to haul or store water (Betts and Slottje 1994).

Contributing to water-quality problems is the lack of facilities for the treatment of sewage. Wastes from both kitchen and bath are usually delivered to nearby outhouses or to septic systems, both of which are unable to absorb and treat the effluent enough to protect ground and surface waters from contamination. Fresh water becomes increasingly scarce as lot size and population density concentrate waste in proximity to the limited water sources. Sewage-treatment facilities are present in only two of the 552 colonias in the valley (Betts and Slottje 1994).

Flooding is a regular occurrence in many colonias. Inundation, a problem in and of itself, also causes contamination of water supplies and soil in low-lying areas as chemicals and biological contaminants are transported into poorly designed neighborhoods. Residents of the Hoehn subdivision near Edinburg, for example, must live with the frequent flooding, as any investment they had already made in the acquisition or improvement of their property would be forfeited in the event that they were to move (Lemieux 1993).

Betts and Slottje (1994) report that from a quarter to a third of colonias residents in the Lower Rio Grande Valley lack proper heating, proper cooling, or both in their homes: "Houses in the colonias are typically substandard, owner-built, wooden, single family dwellings consisting of two rooms plus bathroom and kitchen. Some are made of used cinder blocks with dirt floors and no insulation." The elements easily penetrate the evolving structures best described by the word *jacales* (shacks).

Because colonias tend to be located on land previously used for agriculture, they also tend to be adjacent to (or even surrounded by) agricultural production. The potential for pesticide exposure is high. Pesticides have been found in water samples taken around the region and may be part of the explanation for recent cases of disease clusters. Air pollution from pesticide applications, however, adds a level of complexity to epidemiological investigations into health problems. The distance of travel of *pesticide drift* depends upon many factors, including the chemical properties of the pesticide, the weather conditions at the time of application, and the physical characteristics of the vegetation cover to which it is applied. Little is known about the frequency and extent of airborne pesticide contamination in South Texas. Furthermore, little is known about the repercussions that various combinations of toxic substances will have on human health in the short term. Nothing is known about long-term health risks of very complex combinations of toxic substances from agriculture, industry, and transportation. Policy, in this case, lags far behind the problem.

The political context within which colonias are established is important to the nature of hazards in the lives of the residents. Land outside municipality boundaries is beyond the reach of local land-use controls. Texas has very weak county governments, particularly when it comes to land-use policy, and the state government is usually reluctant to interfere in what are perceived as purely local concerns.

Until very recently, policy makers have been unable to find appropriate laws to slow the development of colonias along the Texas-Mexico border. Four bills introduced into the Texas state legislature, however, would allow Texas border counties to set development standards (equivalent to the municipal standards) for unincorporated areas, require new permits for previously developed subdivisions, place ownership (or equity) back into the buyers' hands to make their right to their property a little less tenuous, and expand state authority to prosecute property owners who develop substandard subdivisions (Garcia 1995).

Health Consequences

Agriculture, maquiladoras, and colonias have set the stage for a significant number of hazards and an increased vulnerability to hazards in the Lower Rio Grande Valley. In the mid-1990s, we have begun to see a rise in health problems among the valley's residents as a result of this overloaded environment. Health officials and residents of the Lower Rio Grande Valley have a puzzle on their hands. Despite areas to the north, south, and west of the valley that have similar socioeconomic and even industrial characteristics, these places do not have the kinds of and rates of disease found in the valley.

The Texas-Mexico border region as a whole has a higher incidence of infectious and other diseases than anywhere else in the United States. Cholera and other intestinal disorders are more common in the colonias, as well as in poor neighborhoods of urban South Texas and sections of northern Tamaulipas. Gastrointestinal disease, amebic and bacilli dysentery, tuberculosis, typhus, and hepatitis-A rates are high. The rates for gastrointestinal disease and hepatitis-A are two to three times that of the entire U.S. El Paso alone has more cases of hepatitis than twenty-four states and more tuberculosis cases than nineteen states. Most of these diseases are spread by waterborne fecal contamination stemming from lack of sewage treatment in colonias on the U.S. side of the border and untreated sewage emanating from the Mexican border towns.

The most frightening and emotionally devastating health problems recently occurring in the Lower Rio Grande Valley are birth defects and childhood diseases. The most widely publicized incidence of diseases among children began to crop up during the first couple years of the 1990s. Something happened in Brownsville and Matamoros to cause a rapid rise in the rate of neural-tube defects (or NTDs) in 1991. In that year, thirteen cases were reported in Brownsville. The expected rate of incidence in the United States is about one to three cases per ten thousand births. The rate in Brownsville was about fifteen times the expected rate for a city of this size.

Across the border, a similar epidemic struck about a year later. Mexican officials reported twenty cases of anencephaly in Matamoros from January to June of 1993. The incidence rate of twelve per ten thousand births is not as high as that experienced in Brownsville, yet it greatly exceeds the U.S. and Mexican rates. Many chemicals (such as PCBs, industrial solvents, mercury, nicotine, and alcohol) have been suspected of contributing to the malformation of fetuses as some studies have found positive correlations (Nusser 1993a; Blatter, van der Star, and Roeleveld 1994). By mid-year 1993, another public health problem was becoming apparent. Neurologist John Seals reported high rates of other brain disorders, known as "migrational defects" because they occur during pregnancy but do not manifest themselves until the child is three or four years old. The visible signs of these defects are: developmental delays, seizures, cerebral palsy, and mental retardation. In only three years, Seals witnessed more childhood neurological disorders in the Lower Rio Grande Valley than he had seen in twenty-two years as a pediatric neurologist in San Antonio. (Associated Press 1993).

Health officials have identified an upward trend in the rate of childhood leukemia, as well. A Brownsville pediatrician, who is partly responsible for identifying the increased incidence of birth defects, has uncovered a sharp increase in the incidence of leukemia over a two-year period. Studying a group of four hundred Brownsville students, she found a single new case of leukemia during the 1990 school year, but by the 1992 school year, seven new cases were recorded. The director of epidemiology for the University of Texas Medical Branch believes these cases might be related to elevated levels of benzene that have been found in Brownsville's air (Nusser 1993b). Though benzene has been shown to cause cancer, little can be done to find absolute proof that benzene or any other single chemical caused these particular cancers.

What's Next?

Using chemicals that threaten the health and environment of people in the Lower Rio Grande Valley is a challenge to residents, to health officials, and to researchers. The problems are complicated by industrial activities, economic forces, cultural issues, and the geographic relationships and interactions among all of these factors. The valley is a chemical landscape, composed of many environmental pollutants with many levels of risk.

The hazardousness of the Lower Rio Grande Valley can be measured. Mapping the activities that produce environmental hazards, as well as mapping the hazards themselves, can generate a mosaic of hazards that may identify the locations of the next hotspot of death, debilitation, deformation, or disease. Until these interactions are better understood, prediction of the next hotspot could simply be anyone's guess.

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The Rio Grande as an International Boundary

11

James F. Petersen

Rivers are not necessarily the ideal type of physical feature to serve as an international boundary. Rivers are dynamic and tend to change their course over time, and this creates boundary problems. What happens to the border, and where is it after the river has shifted its position? In addition to these questions, problems arise about the affected lands and their inhabitants. Have they changed countries and citizenship?

The Rio Grande forms the border between Mexico and Texas for more than twelve hundred miles (two thousand kilometers), from north of El Paso to the Gulf of Mexico. Border issues affect the apportionment of two critical natural resources along the Rio: land and water.

Border Background

Stories of the Rio Grande as an international boundary provide many interesting and varied tales. In 1848 at the end of the U.S.-Mexican War, the Treaty of Guadalupe Hidalgo established the boundary between Texas and Mexico in the Rio Grande (in Mexico, called the Rio Bravo Del Norte). The treaty specified that the center of the deepest channel (*thalweg*, or German for the center of the valley) should serve as the precise location of the boundary and be "religiously respected" by the U.S. and Mexico. The treaty further specified that "no change [should be] made without the free and express consent of both nations."

The thalweg principle came from European traditions based on rivers used as boundaries in humid-climate regions, locations with generally deep, perennial streams. The idea is that the deepest part of the channel should be accessible by nations on each side of the boundary (Boggs 1940). The countries equally share the navigable channel (thalweg). The Rio Grande, however, is not a navigable stream in the sense that applied in Europe, i.e., for riverine navigation, particularly by commercial and naval vessels. The flow of commerce is *across* the Rio Grande, rather than upstream and downstream, the situation that the thalweg concept was originally intended to address.

Unfortunately, streams in an arid environment do not operate exactly like the rivers of a humid climate. Several complicating problems—common characteristics of streams in an arid environment—also concern the Rio Grande. The Rio, like most desert streams, has a highly variable flow regime, flooding in some years (months), and yet, some reaches of the Rio are almost completely dry at other times. Variations or interruptions in the stream flow are not only temporal, but they can also be spatial. William Emory, U.S. Boundary Commissioner in the 1850s, reported that "in 1851 a man drove mules along the riverbed between Presidio and El Paso and found only occasional pools of water." In May 1901, however, the river was almost a half-mile (eight-tenths of a kilometer) wide at Presidio (Gehlbach 1981, 5). Emory recognized immediately that boundary difficulties would arise and that the thalweg does not exist without at least perennial, and spatially continuous, flow.

Periods of flooding tend to be the times when a river's channel changes greatly in form, position, and location of the thalweg. In fact, a case could be made that the thalweg concept is nearly useless in its application along the shallow Rio Grande.

Streams in arid regions have a tendency to form braided stream patterns (an interwoven set of small channels, sand bars, and islands) rather than flowing in a single, well-defined channel. Braided channels represent a river's response to having a discharge of water that is inadequate to move a bed-load of sand and gravel. Braided channels tend to undergo *avulsion*, changing their position frequently and nearly continuously. The resulting problem is this: Where is the boundary if the river splits into two or more channels or forms many shifting channels?

Many squabbles have arisen over land ownership along the river. In some cases, land ownership or sovereignty has been disputed or ambiguous. Sometimes, if ownership was unclear, enterprising individuals were ready to exploit these ambiguities. For example, a world heavyweight-championship boxing match, banned by both the United States and Mexico, was held in 1899 on a disputed Rio Grande sand bar near Langtry (Weisman 1986). The fight was promoted by the infamous Judge Roy Bean, "the only law west of the Pecos." In many cases, lands of undetermined nationality were not effectively governed, and they became havens for smugglers and bandits. The cliché of bandits crossing the river to turn and jeer at the frustrated authorities on the other side may be an exaggeration, but it is not entirely an invention of Hollywood film makers.

In some mountainous regions along the Rio Grande, such as in the Big Bend area, locating the boundary is less of a problem. In the Big Bend region, the Rio Grande flows through narrow, steep-walled gorges (Colorado, Santa Elena, Mariscal, and Boquillas), where one canyon wall is in Mexico and the other is United States territory. One might be tempted to think that these borders are secure, because they consist of nearly vertical cliffs up to fifteen hundred feet high (four hundred and fifty meters), but historically, even this degree of relief has not stopped the occasional flow of contraband over these areas of greatest resistance. Today, a popular use of the river is rafting—true navigation, albeit recreational, along this ribbon of cool water flowing through the canyons of the Chihuahuan Desert.

Meanders as Borders

Meanders are among the most dynamic types of river channels, shifting in a time-frame that is short enough to have effected many changes in the U.S.-Mexico boundary in the last 147 years since the treaty was signed. Meanders form when the banks of a river that is flowing on a gentle gradient are easily erodible. These bends also produce changes in the river on a much larger scale—changes that involve much more land than braiding does. Flowing water in a channel has a natural tendency to form bends. Centrifugal force pushes water against the banks on one side and pulls away on another, eroding one bank and depositing material on the opposite bank. Once curves begin, the bends tend to become more pronounced, forming long, looping meanders (Figure 11.1). There are so many meanders in the lower Rio Grande that the river distance from Del Rio to the Gulf of Mexico is more than twice as long as the straight-line distance.

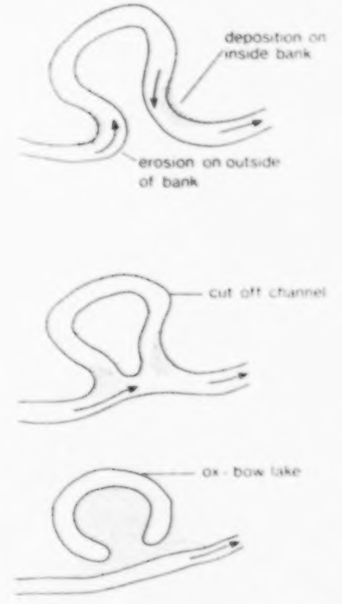

Figure 11.1: Development of a Meander Cut-Off
Source: After Bunnett, R. B. 1988.

The meander neck (the land in the center of the bend) tends to narrow over time, because each side of the neck is formed by the outside bank of a curve. Meander necks are generally low-lying landforms that floodwaters can easily inundate. When a flood washes over a meander neck, there is a good chance for cut-off to occur. A cut-off breaches the neck as the river floods over, erodes a new channel, and bypasses the former channel of the stream. The original channel now becomes a long, thin, curved lake, called an *oxbow lake* because of its shape.

Although *oxbow* is the most commonly accepted term for these resulting landforms, they have many important regional names. Along the Rio Grande in Texas they are called by Spanish names, *bancos* or *resacas*. Bancos are important, because one result of meander cut-off is that the plot of land enclosed by the former channel (oxbow) changes sides of the river when cut-off occurs. The cut-off of meanders along the Rio Grande leaves land formerly on one side of the river on the other side. The question is: Which country governs which tract of land? Furthermore, if people live on the tract, do they change citizenship and residency with each change in the position of the river?

El Chamizal

In the early 1900s, Mexico claimed that a 630-acre (255 hectare) area *north* of the river in El Paso, called El Chamizal, had been *south* of the river at the time that the Treaty of Guadalupe Hidalgo was enacted. Floods in 1864 had apparently shifted the Rio so that El Chamizal, the territory claimed by Mexico, was now on the U.S. side of the river. A dispute ensued, one which resisted solution even by international arbitration in 1910, when Canada decided that most of the disputed land should be returned to Mexico, but the U.S. ignored the decision (Hill 1965). The problem was not resolved until 1964, when the land was satisfactorily divided by the two countries (Prescott 1978). The El Paso-Juarez section of the river had so many problems with meanders that in the 1930s, the U.S. and Mexico began a program to channelize, straighten, and control the river, and along with it, the boundary (Figure 11.2). Until then, the International Boundary and Water Commission had been faced with recurring problems of how to redivide the territory each time the river shifted. After the project was completed, the Rio Grande changed from 155 miles (250 kilometers) in length, with meanders, to 86 miles (138 kilometers) as a channelized stream (Boggs 1940). Land exchanges on opposite sides of the river were negotiated, but it was not until the 1970s that most of the major disputes were finally settled.

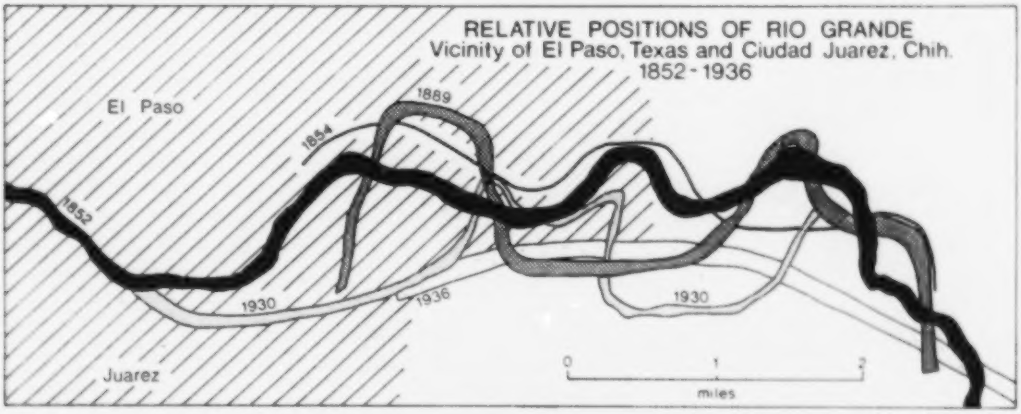
RELATIVE POSITIONS OF RIO GRANDE
Vicinity of El Paso, Texas and Ciudad Juarez, Chih.
1852-1936
El Paso
1889
1854
1852
1930
1936
1930
Juarez
0
1
2
miles

Figure 11.2: Changes in the Rio Grande's Channel near El Paso-Juarez, 1827-1936
Source: Modified from Boggs, 1940.

Water Issues

Inasmuch as land ownership creates one set of border problems, water poses a different set of issues. Colorado, New Mexico, and Texas in the United States share the waters of the Rio Grande with the Mexican states of Chihuahua, Coahuila, Nuevo León, and Tamaulipas. Like most rivers flowing through an arid environment, the Rio fulfills the role of a natural aqueduct.

The Rio Grande headwaters are located at an elevation of about 12,500 feet (3,800 meters) in the San Juan Mountains of Colorado, which form the western side of the San Luis Valley. Here the Rio begins as a mountain stream draining eastward from the Continental Divide through mountain valleys that once contained large valley glaciers during the Pleistocene. Snowmelt today provides considerable water flow to the river. As the river enters the San Luis Valley and before it flows southward into New Mexico, great quantities of water are diverted for the irrigation of three-quarters of a million acres (three hundred thousand hectares) of Colorado farmlands (Gilpin 1949).

The San Luis Valley is part of the Rio Grande Rift, a huge down-dropped part of the earth's crust that continues south into New Mexico as a narrow zone of *grabens* (downfaulted areas) between uplifted mountains. In northern New Mexico, the river has downcut more than a thousand feet (three hundred meters) through a layer of dark basalt to form the Rio Grande Gorge, a popular place for white-water rafting and kayaking. From there, the river flows to Albuquerque on a broad floodplain lined with terraces, which mark higher, ancient levels of the river.

Between Albuquerque and El Paso, the river continues to flow through the desert of the Basin and Range Province. Through New Mexico to the Texas state line, further depletions are made on the water resources of the Rio Grande.

As the river reaches the Texas-Mexico border zone, little flow remains to be shared by these border neighbors, and after flowing through El Paso, the Rio Grande is often nearly dry. South of El Paso-Juarez, between those cities and Big Bend, the Rio Conchos flows northward into the channel of the Rio Grande, delivering fresh water from the mountains of Mexico. Downstream from this confluence, the inflow of water from Mexico is crucial to the people and economies on both sides of the border. Three-quarters of the Rio Grande's water used for irrigating the lower valley in Texas comes from Mexican tributaries (Texas State Historical Association 1952), a situation opposite that of the Colorado River in California, Arizona, Colorado, where water withdrawal is so great that very little flow finally reaches Mexico (Boggs 1940). Downstream from Big Bend (particularly south of Del Rio) in the Lower Rio Grande Valley, the Rio again becomes a meandering stream across a broad floodplain, known for providing excellent irrigable soils for growing citrus and other crops. Despite a history of many disagreements about the use of water by the two countries, the lower Rio Grande has some notable examples of cooperation in resource use.

In the Lower Rio Grande Valley, more than a million acres (four hundred thousand hectares) of land on both sides of the border are irrigated with Rio Grande waters. Two major dams on the Rio represent international cooperative efforts between the United States and Mexico to provide water resources, flood control, and hydroelectric power as well as recreational opportunities. Falcón Lake was developed as a joint project between the U.S. and Mexico in the 1950s to supply both agricultural irrigation water and electricity. Lake Amistad (whose name means "friendship"), near Del Rio, was completed in 1969 and can impound up to five million acre-feet of water. Flood control was particularly important to the Lower Rio Grande Valley, where torrential rains associated with tropical storms or hurricanes caused many problems on both sides of the river. In 1954, the Rio Grande had a flow of one million cubic feet (twenty-eight thousand cubic meters) per second (equal to more than one-and-a-half times the flow of the Mississippi at its mouth) in a storm event estimated to be a two-thousand-year flood (Caran and Baker 1986). In some towns, repeated washing-out of the international bridges caused particular hardships to the local economies, again requiring cooperation to overcome.

Conclusions

The political division of any drainage basin, normally considered to be a *unified* component of the natural landscape, is certain to lead to problems, and this is particularly so when that division forms an international boundary. De Blij (1973) contends that river boundaries are artificial by nature and that cleaving a drainage basin into two longitudinal parts tends to inhibit regional development. Cooperation and understanding will be required to face effectively the challenges of the future. The jurisdiction of two national governments that may have vastly different goals and management strategies certainly compounds the problems of regional resource management.

These neighboring populations, however, share a *border culture* or *border identity*, irrespective of the international boundary line that purports to divide them. Concerning border populations in general, Boggs (1940, 6) once noted:

> In spite of the efforts of the two contiguous countries, each to stamp its language and culture indelibly upon every family and every square mile of its territory, the unity within the zone through which the boundary passes sometimes exceeds the unity between the

> boundary population and distant people of the same nationality. This is the natural result of geographical and...human factors.

Rivers tend to cause the congregation rather than the division of populations on opposite banks. Like the runoff in a watershed, people also tend to flow toward the trunk stream. This tendency is even stronger in an arid region, where water is a limited and precious resource. The populations on each side of the Texas-Mexico boundary share common concerns, problems, heritages, and dreams for the prospects of their divided, but shared, border region. It is this regional sharing that unites, rather than divides the people of the Rio Grande borderland.

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12 A Journey Through Literary Texas

Mark Busby

> Every continent has its own great spirit of place. Every people is polarized in some particular locality, which is home, the homeland. Different places on the face of the earth have different vital effluence, different vibration, different chemical exhalation, different polarity with different stars: call it what you like. But the spirit of place is a great reality.
>
> H. Lawrence, *Studies in Classic American Literature* (1923)

> If a man couldn't escape what he came from, we would most of us still be peasants in Old World hovels. But if, having escaped or not, he wants in some way to know himself, define himself, and tries to do it without taking into account the thing he came from, he is writing without any ink in his pen. The provincial who cultivates only his roots is in peril, potato-like, of becoming more root than plant. The man who cuts his roots away and denies that they were ever connected with him withers into half a man.
>
> John Graves, *Goodbye to a River* (1959)

The spirit of place, or the integral relationship between places and writing, is a quality that many writers attempt to capture. The geographer Yi-Fu Tuan calls this feeling "topophilia," by which he means the perception of sacred place and *genii loci*, the spirits that inhabit particular places in the landscape. Texas folklorist J. Frank Dobie prefers to use the Spanish word *querencia* (from *querer*, to love) for the feelings some living things have for special places. Central Texas writers like Dobie, Roy Bedichek, and Katherine Anne Porter responded to the variety of the Balcones Escarpment, with rolling prairie to the east and the rugged Texas Hill Country to the west. The Balcones Escarpment, which runs nearly parallel to Interstate Highway 35, is therefore a metaphor for the kind of border area where mixtures have flourished historically. The harsh natural environment of the Southwest, however, presents a variety of landscapes as beautiful and appealing as they are dangerous and frightening—arid Chihuahuan and Great Basin deserts, jutting Guadalupe Mountains, eroding Caprock canyon lands, and rolling Llano Estacado—and it inspires among its inhabitants a deep ambivalence.

Historically, writers journeying across the Southwest, from the explorer Cabeza de Vaca to twentieth-century nature writers such as Rick Bass, have attempted to capture their responses to the natural and cultural phenomena they encountered. Much writing about Texas and the Southwest emphasizes encountering a rich variety of human cultures, but just as often, the literature also explores the challenges posed by the natural conditions of the region. This is a region where lush pine forests give way to empty plains, which sometimes stretch so far that the eye yearns for even the slightest hill to lean itself against (as Roy Bedichek commented in his 1947 *Adventures with a Texas Naturalist*), where most of the indigenous vegetation is thorny and fruitless, and where often there is not enough water to sustain either cities or livestock.

Although commentators have noted the importance of place to writers, Texas and Southwestern writers have sometimes suffered from unclear identity. Is Texas Southern or Southwestern? What is the Southwest, and what are its characteristics and literary qualities? Some say the Southwest begins between Ft. Worth and Dallas: Dallas has its banks and money; Ft. Worth, its stockyards. East of Dallas lies farmland, west of Ft. Worth are the ranches. That image might have been accurate twenty-five years ago, but not any more, as the edges of these two cities sprawl from Texas Stadium to DFW (Dallas-Fort Worth) International Airport to the ballpark in Arlington in an almost unbroken line.

Eugene Hollon in *The Southwest: Old and New* says "the term 'Southwest' as hereinafter used refers only to the four large states of Texas, Oklahoma, New Mexico, and Arizona." Lawrence Clark Powell's Southwest is "the semi-arid land from the Pecos of New Mexico and Texas to the Salinas of California, including deserts, mountains, and river valleys, cities and sea-coast." Stanley Vestal says, "By the Southwest I mean West Texas, the western half of Oklahoma, New Mexico, and those parts of Kansas and Colorado which are definitely Southwestern in background and outlook." Vestal excludes Arizona and California because they 'seem a long way off and no part of the [Southwesterners'] world." Kenneth Kurtz's Southwest is Arizona and California. Erna Fergusson draws a triangle from San Antonio, to Los Angeles, and then back to Ft. Worth: inside is the Southwest; outside is out. Tom Pilkington in *My Blood's Country* is more precise: "Texas, New Mexico, and Arizona, plus parts of Oklahoma, Colorado, Utah, Nevada, and Southern California (excluding Los Angeles)." But I leave it to our literary patriarch "Pancho" Dobie, whose definition in *Guide to Life and Literature of the Southwest* is my guide: "The principal areas of the Southwest are, to have done with air-minded reservations, Arizona, New Mexico, most of Texas, some of Oklahoma, and anything else north, south, east, or west that anybody wants to bring in."

Mythic Journeys

In 1853 and 1854 Frederick Law Olmsted, who later designed New York City's Central Park, traveled by horseback across Texas and then published his experiences as *A Journey through Texas*. Traveling is a natural act in a state that covers 266,807 square miles (691,000 square kilometers). It's 801 miles (1,290 kilometers) from the Panhandle in the north to Brownsville in the south and 773 miles (1,245 kilometers) from the easternmost bend in the Sabine River to the westernmost point of the Rio Grande near El Paso. With all this territory, journeying continues to be a necessary reality for the region. Many titles by Texas writers reflect the fundamental importance of journeying: *Waltz Across Texas; North to Yesterday; Moving On; Horseman, Pass By; The Trail to Ogallala; We Pointed Them North; Goodbye to a River; Pale Horse, Pale Rider;* and others.

Journeying has continuing importance in Texas both literally and metaphorically. Many Texas stories are structured by journeys, with searching used as a metaphor for the existential reality of contemporary life. From Saul on the road to Damascus, Oedipus on the way to Thebes, to Odysseus headed home, and Huck on the river, the journey's power as archetype gains added heft in a state where expanse beckons and hinders. Even with the clean outlines of the state's borders to limit a definition, the expanse of the state makes a literary journey complex. How can we make sense of a state as large as Texas? Geographer D. W. Meinig's *Imperial Texas* helps with maps that identify areas of economic and cultural influence. Joel Garreau's *The Nine Nations of North America* provides another view by dividing Texas into three areas: the Breadbasket (the Midwest), Dixie (the South), and MexAmerica (the fastest growing area of influence in Texas). I would first like to outline some qualities of Texas writing and then identify writers in Central Texas and in the other regions of Texas—East Texas, the Gulf Coast, West Texas, and South Texas and the Borderlands (Figure 12.1).

Much Texas writing reflects and transforms elements that define the Southwest, particularly the major elements of the "Texas myth" besides the recurring emphasis on the journey. The myth's foundation rests in frontier mythology that is central to the larger American experience. Frontier mythology refers to a cluster of images, values, and archetypes that grew out of the confrontation between the uncivilized and the civilized world, what Frederick Jackson Turner called the "meeting point between savagery and civilization." Civilization is associated with the past, Europe, cultural refinement, industrial development, and class distinctions, as well as society's institutions, laws, demands for compromise and restriction, and emphasis on manners. Wilderness offers freedom for individuals to test themselves against nature without the demands for social responsibility and compromises inherent in being part of a community.

Texas mythology draws from frontier mythology, particularly the emphasis on Texas as a land of freedom and opportunity, where individuals can demonstrate those values that the Texian Anglo myth reveres: courage, determination, ingenuity, and loyalty, among others. The major indigenous American hero—the cowboy—is a product of the Texas frontier legacy. But Texas's frontier history and geography produce deep feelings of ambivalence. On one hand, the vastness of its area seems to negate borders; on the other, the state's location on the edge of Southern and Western culture and along the long Rio Grande border with Mexico reinforces an awareness of

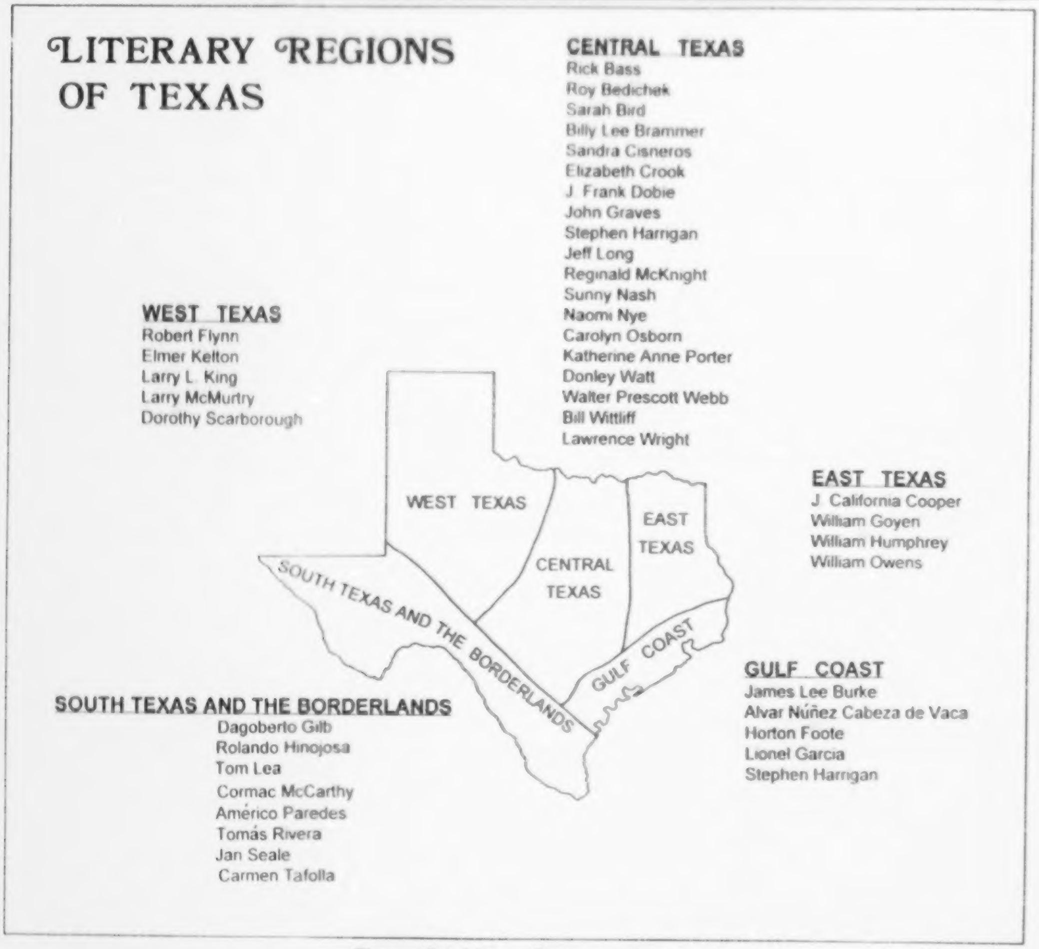

Figure 12.1: Literary Regions of Texas
Selected literary authors and their dominant regions of interest in Texas. Regional boundaries are generalized.

borders. Both borders and the frontier suggest a zone where differing cultures, attitudes, and factions meet. In fact, one of the major features of Texas fiction is ambivalence—the act of being torn in several directions at once. Early settlers, who both conquered nature and felt simultaneously at one with it, began the feelings of ambivalence that Larry McMurtry admitted still cut him "as deep as the bone" in his luminous essay "Take My Saddle from the Wall: A Valediction" in *In a Narrow Grave*. Ambivalence is also central to McMurtry's epigraph for *Lonesome Dove*, which is a quote from T. K. Whipple's *Study Out the Land:*

> All America lies at the end of the wilderness road, and our past is not a dead past, but still lives in us. Our forefathers had civilization inside themselves, the wild outside. We live in the civilization they created, but within us the wilderness still lingers. What they dreamed, we live, and what they lived, we dream.

The ambivalence of being drawn at the same time toward such opposing forces as wilderness/civilization, rural/urban, individual/community, past/present, and numerous others is central to the Southwestern legend, and it grows in intensity in the contemporary Southwest as the schism between old and new tears more strongly at the human heart. Often, Texas writers examine the sharp division between the frontier myth that lives inside and the diminished natural world outside.

Three other important elements of the Southwestern frontier myth were identified by Larry Goodwyn in a 1971 essay titled "The Frontier Myth and Southwestern Literature." Goodwyn first concluded that the "frontier legend is pastoral" with a strong emphasis on primitivism. Second, "the legend is inherently masculine: women are not so much without 'courage' as missing altogether; cowgirls did not ride up the Chisholm Trail." Third, Goodwyn found that the frontier myth "is primitively racialist: it provided no mystique of triumph for Mexicans, Negroes, or Indians."

The ambivalence of contemporary writers often stems from these older elements. The primitivism of the legend, with its emphasis on the positive values that living close to the land breeds, certainly contributes to these feelings of ambivalence. Bookish people spend much time inside libraries or in front of infernal word-processing machines while they contemplate the expanse of space that defines the state. These writers know that the majority of Texans—more than 82 percent—live in urban areas. They also realize that many of Texas's remaining natural areas along rivers and coastlines are threatened by some of the foulest polluters, who are free to exercise the liberty that a "guvment"-hating state allows.

The sexism and racism of the old legend continue to call forth important answers from women and minority writers, who articulate their own views of the world, and from others who are sensitive to these ugly legacies. These writers include such Texas women writers as Sarah Bird, Naomi Nye, Carolyn Osborn, Carmen Tafolla, Sunny Nash, Jan Seale, and Sandra Cisneros; other Mexican American writers such as Rolando Hinojosa, Lionel Garcia, and Dagoberto Gilb; and African American writers such as Reginald McKnight and J. California Cooper.

Two-and-a-half decades ago, in *In a Narrow Grave,* McMurtry called for Texas writers to shift from the harsh physical landscape of the Southwest to the largely unexplored emotional one when he said that Texans' "emotional experience remains largely unexplored," mapping the territory for "the dramas, poems and novels" of future Texas writers. McMurtry went on to say that an "ideal place to start, it seems to me, is with the relations of the sexes, a subject from which the eyes of Texas have remained too long averted." Increasingly, the eyes of the writers of Texas fiction focus on male-female relationships in both the livelong days and the passing nights.

To these elements of Texas mythology—journeying, ambivalence, primitivism, racism, and sexism—another ambiguous element continues from the frontier past: violence. In an *Atlantic* essay in 1975, McMurtry excoriated Texas, noting that the frontier emphasis on violence was one of the few vestiges of the old world still hanging on:

> If frontier life has left any cultural residue at all, it is a residue of a most unfortunate sort—i.e., that tendency to romanticize violence which is evident on the front page of almost every Texas newspaper almost every day.

Richard Slotkin examined the implications of the myth of violence in *Regeneration through Violence: The Mythology of the American Frontier, 1600-1860,* in which he identified the archetypal pattern: the American hunter who journeys out into the wilderness, confronts the Indian in a violent confrontation, and thus regenerates himself and his people. Contemporary Texas demonstrates the sad reality of this dubious legacy, and Texas literature has often examined the Texas propensity to promote violence in hunting, bar fights, casual confrontations, and random savagery.

Expatriate but perennial Texan Larry L. King mused about the Texas of myth in *Of Outlaws, Con Men, Whores, Politicians, and Other Artists* as he considered his various returns to his blood's country beyond San Angelo:

> Never have I rounded the turn leading into that peaceful valley, with the spiny ridge of hills beyond it, that I failed to feel new surges and exhilarations and hope. For a precious few moments I exist in a time warp: I'm back in Old Texas, under a high sky, where all things are again possible and the wind blows free. Invariably, I put the heavy spurs to my trusty Hertz or Avis steed: go flying lickety-split down that lonesome road, whooping a crazy yell and taking deep joyous breaths, sloshing Lone Star beer on my neglected dangling seat belt, and scattering roadside gravel like bursts of buckshot. Ride 'im, cowboy! *Ride* 'im....

This mythic Texas is a lie in the mind, denied by livestock crammed into squalid cattle yards; oil busts; crack and coke hustlers; and fouled creeks, streams, and bayous. Yet, it is a powerful myth that still grips the minds of supporters and attackers alike, and it will continue to incite the dialogue of Texas throughout the varied regions.

Central Texas

Older Central Texas writers include the Big Three of Texas fiction: J. Frank Dobie, Walter Prescott Webb, and Roy Bedichek (see Figure 12.1). In fall 1994, a group of Texans led by Lawrence Wright, Stephen Harrigan, Tommy Lee Jones, and Rip Torn completed a fund-raising campaign to have the statue of these three famous Texans placed at the entry of Barton Springs in Zilker Park in Austin. It is a major irony that what Larry McMurtry once called a "bookless state" has now commemorated the lives of three writers. It is also ironic that these three white men are the first writers to be so commemorated in Austin and that the statue does not include the most nationally influential Central Texas writer, Katherine Anne Porter, who grew up just five miles (eight kilometers) north of San Marcos in the small community of Kyle. Porter's stories such as "The Grave" and "Noon Wine" are set in Central Texas, and almost every major anthology of American literature taught in college classes includes a story by Katherine Anne Porter, whereas none includes work by the Big Three.

Twenty years ago, probably any list of Texas books would have included two or three of Dobie's books in the top five, mainly because Dobie was "Mr. Texas," the man who almost single-handedly brought Texas literature to some kind of respectability. Neither a fiction writer nor a scientific folklorist, Dobie was a raconteur, a collector of stories. Still, most collectors of Texas books begin with copies of Dobie's *Coronado's Children, Tongues of the Monte, The Longhorns, The Mustangs,* and *Tales of Old Time Texas.* Central Texas writer Bill Wittliff, who wrote the scripts for *Lonesome Dove* and *Legends of the Fall,* attributes his initial interest in writing to reading Dobie as a young boy growing up in Blanco.

Walter Prescott Webb was a historian, whose book *The Texas Rangers* helped establish the Ranger myth, which still appears in Texas popular culture from former Rangers Call and McCrea in *Lonesome Dove* to the television series "Walker, Texas Ranger." Webb glossed the racism attributed to the Rangers in border wars, and his book *The Great Plains* tends to stereotype Indians and Mexican Americans. Still a recent survey of Western historians identified Webb's book as the most influential book that shaped their views of Western history.

Roy Bedichek, the third member of the "Big Three," was for many years director of the University Interscholastic League, and he began writing only after retiring from the league when he was nearly seventy. As Tom Pilkington has noted about Bedichek:

> A lifetime of observing nature and of wide and intelligent reading had produced a truly remarkable understanding of the working of the natural order. His *Adventures With a Texas Naturalist* (1947) is a quiet statement of joy in the observation and appreciation of the state's plant- and wildlife; it is at once a philosophical treatise, a celebration of life, and a minor classic in the field of natural history. *Karankaway Country* (1950) and *The Sense of Smell* (1960), sequels to his first book, are on only a slightly lower level of achievement.

The primary inheritor of the Big Three's mantle is now the dean of Texas letters, John Graves, whose area of Central Texas is just north of the Big Three's area of operation around Austin. Reading Graves's three major works, *Goodbye to a River* (1959), *Hard Scrabble* (1974), and *Notes from a Limestone Ledge* (1980), makes you feel as though you have made a friend. After riding down the river in his canoe and listening to him ruminate about the virtues of hard-scrabble farming or the disappearance of his dog Blue, you have spent much quality time with the kind of writer who gets inside you, who speaks with a clear personal voice, so that when you are through with a book you know more about him that you do about people you've known for decades. Graves's area is the Brazos River near Glen Rose. The account of his trip down the river is now a classic. Ironically, near his Glen Rose ranch called Hard Scrabble, and not far from a small hill called Comanche Peak, is a nuclear power plant named for the hill.

An important Central Texas writer who staked out urban Texas was Billy Lee Brammer, whose one published work, *The Gay Place* (1961), has become the classic Texas political novel. (The title reflects its time, not ours, and refers to a happy place.) Brammer, who served as an assistant to Lyndon Johnson, attempted to imagine what Texas would have been like had Johnson been governor of Texas. Brammer never realized his potential as a writer and died of a drug overdose at age forty-eight, but his novel lives, newly reissued by the University of Texas Press.

Newer Central Texas writers abound, from Bill Wittliff, Stephen Harrigan, and Lawrence Wright, to Sarah Bird, Carolyn Osborn, Elizabeth Crook, Donley Watt, and Rick Bass, who has traveled widely and now lives in Montana. Bass's *The Deer Pasture* (1985) uses the Central Texas Hill Country for its setting.

East Texas

Physically and historically, East Texas has strong ties with the South. The green Piney Woods and lush blackland soil of much of East Texas look more like the South, and many of the early settlers of East Texas brought slavery and cotton farming with them when they left the South. It was their influence that led Texas to join the Confederacy. Yet, one deep East Texas town, Nacogdoches, was also one of the earliest outposts on the northern frontier of New Spain, and it has a strong Spanish influence that ties it to San Antonio rather than to Vicksburg or Atlanta. East Texas writers often claim the Southern heritage, especially since the influence of William Faulkner looms heavily over American literature. Three of the most important East Texas writers are William Humphrey, William Goyen, and William Owens. Humphrey is probably the best known, primarily because his novel *Home from the Hill* was made into a film starring Robert Mitchum. Goyen was more of a stylist, but both his novel *The House of Breath* and Owens's *Fever in the Earth* (1958) are concerned with the importance of oil on the lives of East Texans.

West Texas

West Texas's (and arguably Texas's) best-known writer is Larry McMurtry, a prolific writer who grew up in the small town of Archer City, just south of Wichita Falls. Between 1961 and 1994, McMurtry published sixteen novels, two books of non-fiction, several screenplays, and hundreds of book reviews. Five of his novels have been made into movies, and one into a television mini-series. A compulsive writer, he gets a headache if he does not complete his self-imposed task of writing at least five double-spaced pages every day—more than 1,800 manuscript pages a year. On volume alone, he has moved a long way from the sweatshirt he used to wear with "Minor Regional Novelist" ironically emblazoned on it, and among his many novels are *Horseman Pass By* (1961), renamed "Hud" in the movie version, *The Last Picture Show* (1966), *Terms of Endearment* (1975), *Somebody's Darling* (1978), *Cadillac Jack* (1982), *The Desert Rose* (1983), *Lonesome Dove* (1985), *Texasville* (1987), *Buffalo Girls* (1991), and *Streets of Laredo* (1993).

Another West Texas writer of prominence is Elmer Kelton. Where McMurtry has taken a critical approach to traditional Texas literature, Kelton has taken the traditional Western genre novel and moved beyond it. Kelton has published several important novels about Texas, including *The Day the Cowboys Quit* (1971), *The Good Old Boys,* (1978), *The Man Who Rode Midnight* (1987), and *The Time It Never Rained* (1973). *The Good Old Boys* was made into a highly acclaimed 1995 television movie directed by and starring Tommy Lee Jones. Kelton has won the Texas Institute of Letters fiction award and is widely respected as a historical novelist. Although his work has been compared to those of Louis L'Amour, Kelton notes that where L'Amour's western heroes are six-foot-two and courageous, his main characters are five-foot-eight and scared.

Another important West Texas writer is Robert Flynn from Chillicothe. Until the mid-1980s Flynn's modest reputation rested on a little-known novel titled *North to Yesterday,* published in 1967. Although he won the Western Heritage Award, in the 1970s Flynn seemingly stopped publishing. *North to Yesterday* went out of print, but the novel's supporters continued to praise it. Flynn began to publish again in the mid-1980s, and he is now one of the most important writers in Texas and was the president of the Texas Institute of Letters from 1990 to 1992. With *Wanderer Springs* (1988), Flynn returned to his mythical West Texas town. His newest novel is *The Last Klick,* a Vietnam novel that grew out of Flynn's experiences as a correspondent there.

The Gulf Coast

The Texas Gulf Coast stretches from the bayous of Louisiana to the salt marshes leading to Brownsville, including the oil-refining areas around Beaumont/Port Arthur, the urban port of Houston, and the tourist-rich areas of Galveston and Corpus Christi. Several Texas writers hail from the Gulf Coast of Texas, notably Horton Foote, James Lee Burke, and Stephen Harrigan. Foote, best known for his plays and scripts such as *Trip to Bountiful* and *1918*, also wrote the novel *The Chase*. James Lee Burke is best known for his Louisiana detective Dave Robicheaux, but Burke draws from his Texas Gulf Coast background as well. Harrigan has lived in Central Texas now for twenty years, but he grew up along the coast, and his novel *Aransas* is one of the best books about the coast.

The Gulf Coast is also associated with the first major book about Texas and the Southwest, Alvar Núñez Cabeza de Vaca's *Relación*, which is the story of his time after being shipwrecked along the coast (probably near Galveston) in 1528. When Cabeza de Vaca washed up on the shores of Texas after an ill-fated expedition with the Spanish explorer Narvaez, he labeled the island *Malhado* (or Misfortune Island, the Island of Doom). His is the first book recounting a confrontation and reconciliation between European explorers and native peoples, and it has all the elements of good literature: structure (escape and return, journey, mythic parallels, frontier myth, regeneration through violence) and the elemental theme of a man's survival after having been stripped of all resources but his own mind and imagination.

South Texas and the Borderlands

The most notable Anglo writer associated with the Border region is Tom Lea, who developed a reputation as both a painter and a writer. Lea wrote a lengthy history of the King Ranch and two important novels, *The Brave Bulls* and *The Wonderful Country*. Since the mid-twentieth century, Mexican American writers in South Texas have become increasingly important, led initially by Américo Paredes, a folklorist who taught at the University of Texas for many years. Paredes collected the *corridos* (Mexican folk ballads) about Gregorio Cortez and eventually wrote up the legend in *With His Pistol in His Hand*, published in 1958. (Corridos originated along the border, and they usually dealt with skirmishes between Mexican-Americans and Texas Rangers and celebrated the courage of Mexicans who stood up against the oppressive Rangers.) In 1982, the story of Gregorio Cortez was transformed into art in a film called *The Ballad of Gregorio Cortez*, based upon a series of corridos about a Tejano who shot a sheriff.

Other important Mexican American authors of South Texas include Tomás Rivera, whose one novel, *And the Earth Did Not Devour Him* (1970) has recently been filmed. The second major writer is Rolando Hinojosa, whose several books about the Rio Grande Valley constitute a continuing series, *Estampas del valle y otras obras* (Sketches of the Valley and Other Works). Among Hinojosa's works are *Dear Rafe* (1981), *Rites and Witnesses* (1982), *The Valley* (1983), and *The Useless Servants* (1993). One of the hottest Mexican American border writers is Dagoberto Gilb, a journeyman carpenter from El Paso. In 1994, he won a prestigious Whiting Award. He is best known for his collection of stories, *The Magic of Blood* (1993) and a novel, *The Last Known Residence of Mickey Acuña* (1994).

These regional categories help make some sense of the variety of Texas literature, but the categories overlap (writers may be both Gulf Coast and East Texas writers, for example), and in this mobile society, writers move around. Even within the categories is great variety, evidenced by the title of biologist Frederick Gehlbach's book *Mountain Islands and Desert Seas*, which describes the physical changes that elevation causes across the region. This variety also indicates the vitality of Texas literature. The "bookless" state once described by McMurtry has certainly been transformed.

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Part II:

Learning Activities

The Edwards Aquifer

1

Isobel Stevenson

Introduction:

Ground water is a precious natural resource. San Antonio and much of central Texas receives their water supply from an underground source called the Edwards Aquifer, named after the Edwards Plateau. An aquifer is a system of underground layers of gravel, earth, or porous rock that yields water. The Edwards Aquifer of central Texas is different from most aquifers in the United States in that it is a limestone (a relatively impermeable rock), or karst, aquifer. Most aquifers are sandstone, or granular (materials such as sand and gravel). This lesson examines the implications of this fact.

Grade Level: Grades 6-12

Time Required: 1 class period

National Geography Standards*: (appropriate page numbers cited for standards, grades 5-8 and 9-12)

4. The physical and human characteristics of places. 150-151; 190-191.
14. How human actions modify the physical environment. 171-172; 212-213.
18. How to apply geography to interpret the present and plan for the future. 181-182; 221-222

**Geography for Life: National Geography Standards*. 1994. Washington, D.C.: National Geographic Research and Exploration.

Vocabulary:

aquifer, karst, impermeable, strata, recharge zone, drainage area and contributing zone

Objectives:

- Students will explain the difference between a karst aquifer and a granular aquifer, and use this information to recommend environmental guidelines to protect water quality.

Materials:

- Map and diagram of the Edwards Aquifer (provided)
- Answer sheets to map and diagram (provided)
- Overhead transparency master of karst and granular aquifers (provided)
- Map of Texas that shows counties
- An empty soft-drink can with holes punched in it
- A strainer filled with sand
- Water

The Learning Activity: (See Chapters 2 and especially 3 in this site guide)

- *Background:*

The Edwards Aquifer is a limestone formation layered in places with relatively impermeable strata that confine the water. It stretches northeast to southwest for 250 miles (400 km) from Bell County, north of Austin, to Brackettville in Uvalde County. The aquifer can be described in terms of zones. The recharge zone is the land surface through which rainfall, runoff, and stream flow percolate into the aquifer, thereby replenishing the water supply. The drainage area, or contributing zone, is the area upstream of the recharge zone from which runoff and stream flow may eventually enter the recharge zone. In the artesian, or reservoir, area, the limestone is confined between relatively impermeable rock and is under sufficient pressure to force water up through wells (an artesian well is a well that flows without need of a pump). The nature of limestone aquifers is such that bacteria from treated effluent (used to water golf courses) and pollutants (such as lead) from urban runoff are carried swiftly through underground channels to emerge at the springs. The Edwards Aquifer is the major water supply for most of the San Antonio region.

- *Executing the activity:*

Introduce the term aquifer. Explain that although a small proportion of the population of the United States gets its water from underground aquifers, in some areas, like central Texas, for example, aquifers are a very important water supply. The Edwards Aquifer is the only supply of water to the city of San Antonio and supplies water to 1.3 million people in central Texas.

Using a map of Texas, have students label the map of the Edwards Aquifer. Then, have them use both maps to draw their own sketch map of Texas to show the location of the Edwards Aquifer relative to major cities, and possibly other features as well.

Use the overhead transparency of karst and granular aquifers to teach students the difference between them. You can also demonstrate the difference in filtration capability and stream flow by pouring water into an empty soft-drink can with holes punched in it, to represent the karst aquifer, and a strainer filled with sand to represent the granular aquifer.

Divide students into groups, and ask them to summarize the differences between karst and granular aquifers, and then derive the implications these differences have for the protection of water quality.

Worksheets are provided to familiarize the students with a part of the area that the Edwards Aquifer covers (from San Antonio to San Marcos). This is called the San Antonio segment of the aquifer, because this segment behaves as a separate unit, and supplies water to that city. A diagram showing how the aquifer works is also included. Answers to the worksheets are provided with this lesson. Worksheets are from *Edwards Aquifer: A Texas Treasure*, a teacher's guide for grades 7-12, and used with permission, courtesy of the Edwards Underground Water District, PO Box 15830, San Antonio, TX 78212.

- *Evaluation:*

Have the students write a letter to a newly elected official explaining why the Edwards Aquifer is unique and outlining what measures ought to be taken to protect it.

Answers for *Geography of the Edwards Aquifier Region* handout

Counties: (lower tier west to east) Kinney Co., Uvalde Co., Medina Co., Bexar Co.

(upper tier west to east) Edwards Co., Real Co., Kerr Co. (north), Bandera Co. (south), Kendall Co., Comal Co., Hays Co.

Towns/Cities (west to east): Uvalde, Hondo, San Antonio, New Braunfels, San Marcos.

Answers for *The Edwards Aquifer and Hydrologic Cycle* handout

Drainage Area, Recharge Zone, Artesian/Reservoir Area

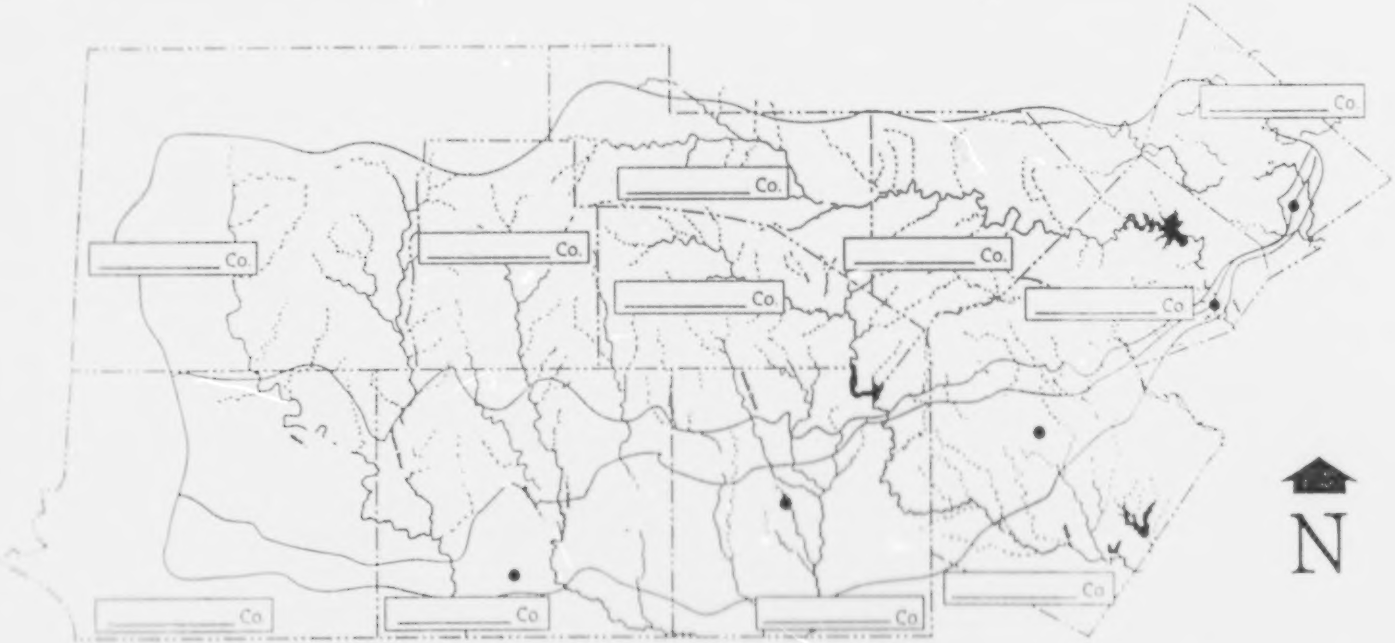
water table aquifer

artesian spring
Balcones fault zone

artesian well
Edwards artesian aquifer

Rocks:
Del Rio Clay
Edwards Limestone
Glen Rose Limestone

Geography of the Edwards Aquifer Region



In the Artesian/Reservoir Area, the water flows generally from west to east.

The drainage basins of the Edwards Plateau act as funnels, collecting runoff from the Drainage Area into streams that cross the Recharge Zone.

Find and label: The 11 counties and five cities indicated on the map.

Use three colors or patterns to indicate the location of the three hydrologic regions.

Make a legend.

KEY

Handout 1.1: Map of Edwards Aquifer Region

Source: Edwards Aquifer, Tex.: Edwards Underground Water District, 1991.
P.O. Box 15830, San Antonio, TX 78212. Used with permission.

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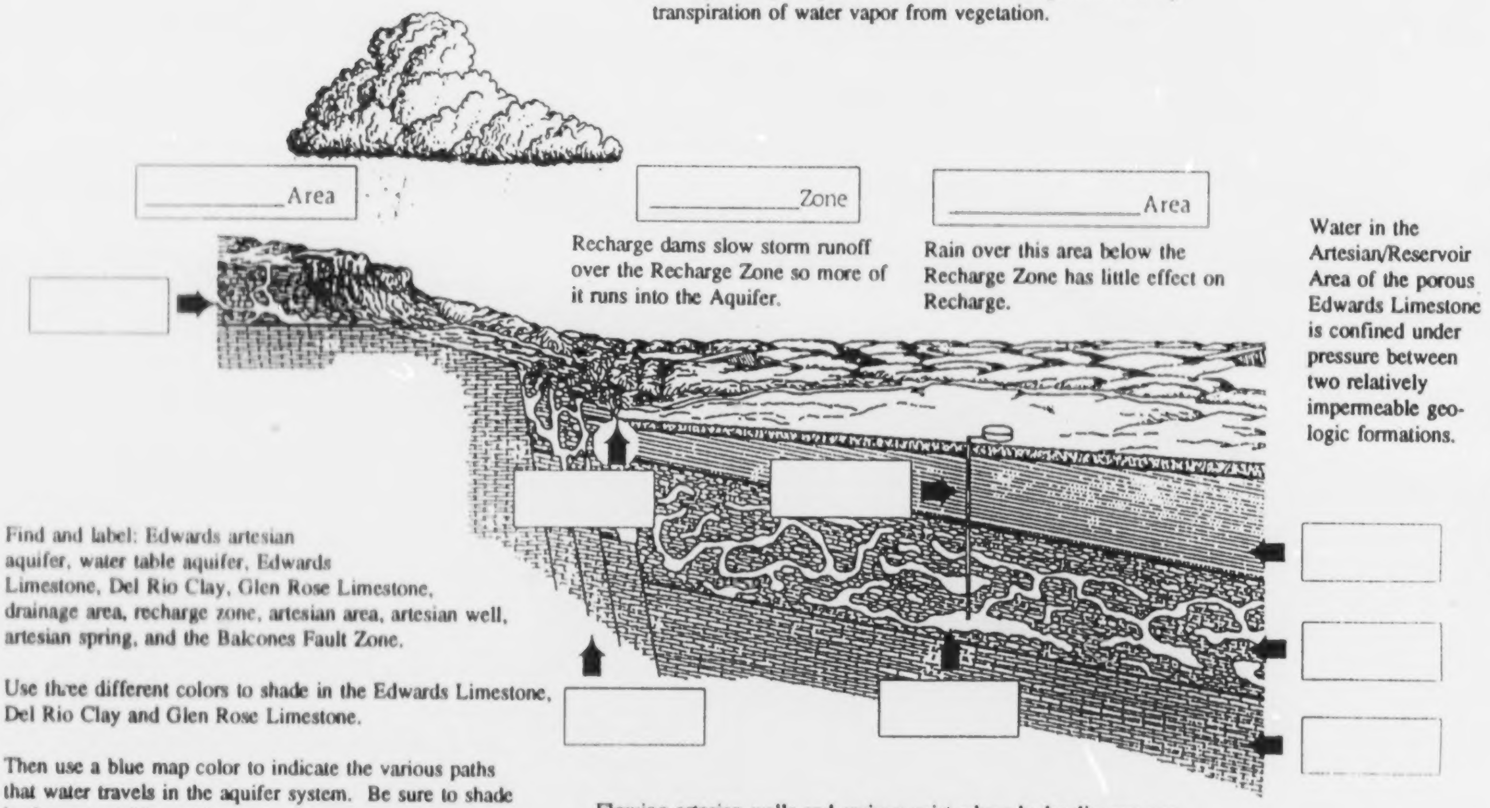
Water moving through the Edwards Aquifer

About 85% of precipitation falling on the area is lost back to the atmosphere by evaporation due to warm temperatures or by transpiration of water vapor from vegetation.



Recharge dams slow storm runoff over the Recharge Zone so more of it runs into the Aquifer.

Rain over this area below the Recharge Zone has little effect on Recharge.

Water in the Artesian/Reservoir Area of the porous Edwards Limestone is confined under pressure between two relatively impermeable geologic formations.

Find and label: Edwards artesian aquifer, water table aquifer, Edwards Limestone, Del Rio Clay, Glen Rose Limestone, drainage area, recharge zone, artesian area, artesian well, artesian spring, and the Balcones Fault Zone.

Use three different colors to shade in the Edwards Limestone, Del Rio Clay and Glen Rose Limestone.

Then use a blue map color to indicate the various paths that water travels in the aquifer system. Be sure to shade in the water table aquifer, recharge streams and the artesian aquifer.

Flowing artesian wells and springs exist where hydraulic pressure is sufficient to force the water up through wells and faults to the surface.

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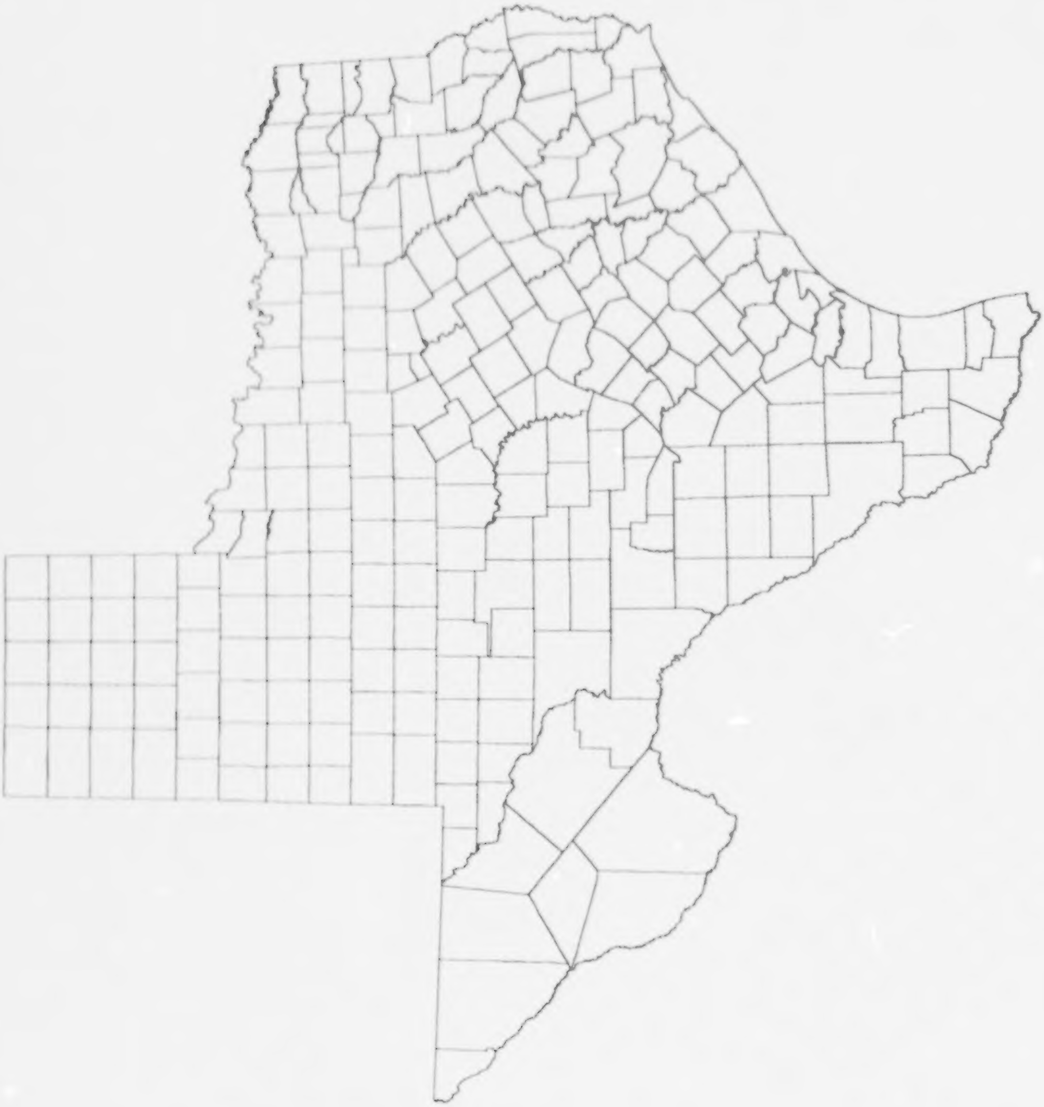
Handout 1.2: Diagram of Edwards Aquifer and the Hydrologic Cycle

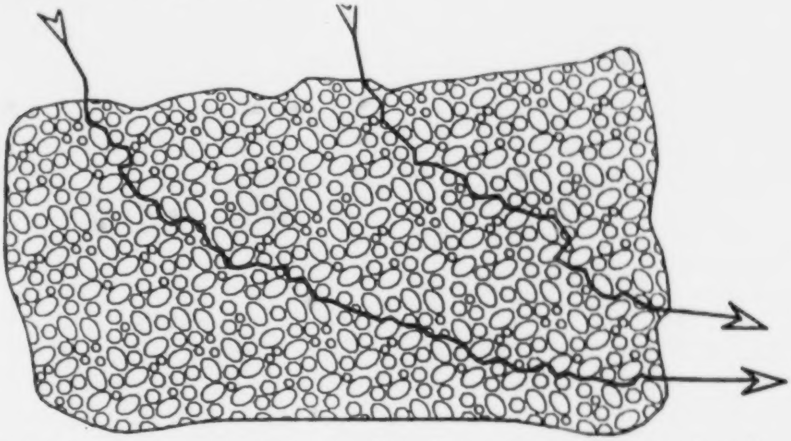
Source: Same as Handout 1.1. Used with permission.

Handout 1.3: Map of Texas Showing County Boundaries



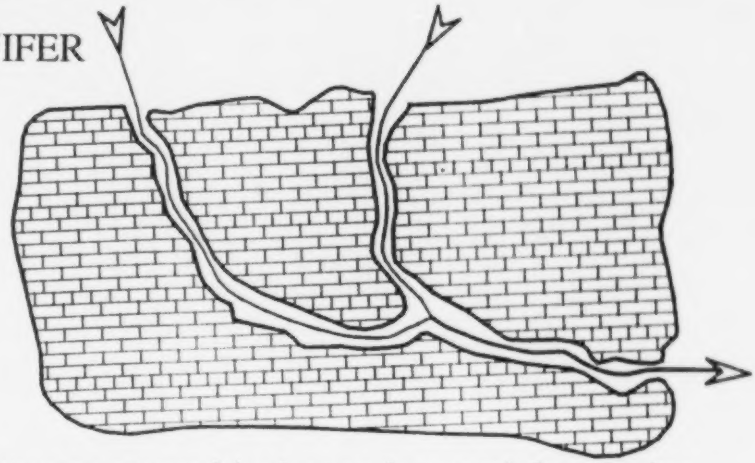
Transparency 1.1: Granular and Karst Aquifers (drawn by I. Stevenson)

GRANULAR AQUIFER



- gaps between particles smaller than one sixteenth of an inch
- liquids flow only inches in one day
- many pollutants filtered out
- liquids remain in aquifer for extended periods, giving bacteria a long time to die off

KARST AQUIFER



- openings between several inches and several feet in size
- liquids flow 30-150 feet per hour
- little or no filtration takes place
- pollutants, sediments, and bacteria flow to spring

Donde Voy (Where I Go)

Philip Rodriguez

2

Introduction:

The largest numbers of immigrants in Texas come from countries south of the United States. Songs with themes of migration are used in this lesson to help students identify push/pull factors that lead to migration and problems associated with migration. The purpose of this activity is to help students develop an understanding of the difficulties immigrants encounter when seeking better living conditions.

Grade Level: Grades 6-12

Time Required: Two hours

Objectives:

- Students will explain why human activities require movement.
- Students will identify push/pull factors that lead to migration.
- Students will be aware that movements reflect global patterns of interaction.
- Students will communicate some of the problems associated with migration.
- Students will infer some of the emotions of immigrants entering the country.

National Geography Standards*: (appropriate page numbers cited for standards, grades 5-8 and 9-12)

1. How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective. 144-145; 184-185.
4. The physical and human characteristics of places. 150-151; 190-191.
6. How culture and experience influence people's perceptions of places and regions. 154-155; 195-196.
9. The characteristics, distribution, and migration of human populations on Earth's surface. 160-161; 201-202.
12. The processes, patterns, and functions of human settlement. 167-168; 208-209.

**Geography for Life: National Geography Standards.* 1994. Washington, D.C.: National Geographic Research and Exploration.

Materials:

- Compact disk or cassette recording of "Homeland," by Tish Hinojosa (A&M Records, 1989)
- Compact disk or cassette player
- Worksheets (questions provided)
- 3 x 5 cards to make push/pull cards (information provided)

The Learning Activity:

- *Background:*

Introduce students to the processes and history of migration in the United States. Migration is the general term to describe any transfer of population from one place to another. Emigration (by emigrants) describes leaving a country to settle in another; immigration (by immigrants) denotes coming into the new country. People who migrate to a new country often find themselves a minority in the new country. The immigrant is set apart from the dominant group by cultural or physical traits, or by religious affiliation.

The diversity of the American people is unmistakable evidence of the variety of places from which immigrants have come to this country. The different immigrating people did not necessarily welcome one another. Instead, they brought their European rivalries and biases to the New World. The Chinese were the first to be singled out for restriction, with the passage of the 1882 Exclusion Act. The Chinese became the scapegoat for America's sagging economy in the last half of the nineteenth century. Growing fears that increasing numbers of un-American types were immigrating motivated the creation of the national origins system and the quota acts of the 1920s. These acts gave preference to certain nationalities, until the passage of the Immigration and Naturalization Act of 1965 ended that practice. Controversy continues to surround the policy of the United States toward refugees and illegal aliens.

Complex forces cause people to emigrate. The most important have been economic, such as serious financial hardships in the old country and perception of higher incomes and higher standards of living in the new homeland. Other factors included dislike of political regimes, racial or religious prejudice, and desire to reunite family members who had previously emigrated. Immigration to the United States has at times been made easier by cheap ocean transportation and by other countries' removal of restrictions on emigration. All these factors push individuals from their homelands and pull them to other nations, such as the United States. In all types of movement, two sets of forces operate: push factors, and pull factors. Push factors discourage a person from remaining where he or she lives. Pull factors attract an immigrant to a particular country, region, or place.

The reception given to immigrants in the United States has not always been friendly. Open bloodshed, restrictive laws, and the eventual return of some immigrants to their home country attest to the uneasy feeling toward strangers who wish to settle in the U.S.

In the twentieth century, we have seen huge population movements caused by two world wars; revolutions in Spain, Hungary, and Cuba; the partition of British India; conflicts in Southeast Asia, Korea, and Central America; and confrontation between Arabs and Israelis. Economic conflict can also lead to human migrations. The potato crop failure of the 1840s (commonly referred to as the potato famine) forced millions of Irish and German people out of their home countries.

Although people may emigrate voluntarily, leaving the home country is not always a result of individual choice. Throughout human history, conflicts, wars, and serious financial hardships have displaced people from their homes. Sometimes people are forced to move against their will. For example, slaves or indentured servants were brought to the United States and to other European countries in the Americas. Involuntary migration is no longer common. Although enslavement has a long history, all industrial societies today prohibit such practices. Of course, many contemporary societies today bear the legacy of forced labor migration.

- *Executing the activity:*

Discuss with the students some of the pleasures they enjoy at home. Make sure that the discussion includes spiritual pleasures as well as present-day material pleasures. Create a scenario in which all or most of the items they hold as valuable are taken away (they live in poverty, for example). Ask what they might do to obtain them, using push and pull factors in the discussion.

Put each item from the following list on a 3 x 5 card:

Wages in your town are very low.
Good medical care is not available locally.
Some people in your state have suffered political persecution.
New jobs for young people are hard to find.
Your children are not likely to get a good education.
You have heard that the standard of living is higher in the USA than in the country where you now live.
You want to join family members who live in Texas.
You would like your children to have the opportunity to go to college.
You want your children to be able to find good jobs.
You want the very best medical care for your family.
Most of your family still live in your home town, including your parents.
You have heard that crime rates in American cities are very high.

Crossing the border can be difficult or dangerous for an illegal migrant.
You do not speak any English.
You would have to live as a fugitive in the United States.

Select one student to represent a Mexican citizen contemplating a move away from his or her homeland. Ask the student to stand in the middle of the room. Put the other students into small groups. Give each group a card, and give them a few minutes to write a short statement elaborating on the effect(s) that the factor on the card might have on the Mexican citizen, and therefore whether it is a push or pull factor, or a reason for staying. Ask the Mexican citizen to make a decision on whether or not to migrate, and what reasons most influenced that decision.

Review with the students the difficulties and the pains in making the decision to move. Collect the cards and proceed to the musical portion of the lesson.

Distribute the activity worksheets to the students. Introduce and play the first song, "Joaquin," to the students and allow them ample time to brainstorm and respond to the answers (5 to 10 minutes). Then, introduce and play "*Donde Voy*" to the students. Allow them ample time to brainstorm and respond to the answers (5 to 10 minutes). Finally, introduce and play "West Side of Town." Allow the students ample time to brainstorm and respond to the answers (5 to 10 minutes). After the students have brainstormed and completed the third set of questions, have them move their desks into a large circle to discuss their responses to the questions. End the discussion by reviewing what they have learned and how this lesson relates to the Five Fundamental Themes of Geography [Location, Place, Relationships within Places (Human/Environment Interactions), Movement, and Regions] from the *Guidelines for Geographic Education: Elementary and Secondary Schools*. (Joint Committee on Geographic Education. Macomb Ill. and Washington, D.C.: National Council for Geographic Education and Association of American Geographers, 1984: 3-8).

Extensions:

- Have students plan the route Joaquin may have taken. On a map, have them determine the mode of transportation, the mileage of the trip, and the travel time.
- Have students play the role of Joaquin and write a log or diary (based on the first extension) of the journey. In the log, the students will enter the hardships they have encountered on the trip north.
- Have students impersonate Joaquin writing a letter home to San Luis Potosí (state and city of central Mexico) telling his loved ones of his life and his plans for the future.

Border Trilogy: Three Songs by Tish Hinojosa

Joaquin (from "Homeland" by Tish Hinojosa)

Joaquin shed a tear for the treason
But who'd hear his desperate cry?
He learned to speak English from tourists
And reading by kerosene light
He couldn't afford education
But something was burning inside
He heard things were good in America
And that's what had been on his mind
I met him when I was travelin'
Through Mexico one summer day
Eyes twice as old as the young man
Who taught me a lesson in faith
Fate made him poor but he knew there was more
Though I never did see him again
I know somewhere in America
Joaquin must've found him a place

Chorus
Joaquin loves his homeland
But it can't give him enough
He wants a good life, a job, and a wife
And some children with dreams that come true
Moonless night crossing the badlands
echo: *Ayuda me Dios* (Help me God)
Sign of the cross o'er his chest
echo: *Mi vida me fe* (my life my faith)
Pounding heart racing 'til sunrise
Mile after mile without rest
Back at the border there's papers
But politics get in the way
It may not be right but they take through the night
Some pay for the dream with their lives.

"Joaquin" © 1989 Almo Music Corp. and Manazo Music (ASCAP)
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Donde Voy (Where I Go) (from "Homeland" by Tish Hinojosa)

Line
Madrugada me ve corriendo 1
(Daybreak finds me running)
Bajo cielo que empieza color 2
(Under a sky beginning to color)
No me salgas sol a nombrarme 3
(Sun please don't expose me)
A la fuerza de "la migracion" 4
(To the force of the INS)
Un dolor que siento en el pecho 5
(The pain that I feel in my chest)
Es mi alma que llere de amor 6
(Is my heart that hurts with love)
Pienso en ti y tus brazos que esperan 7
(I think of you and your arms that wait)
Tus besos y tu passion 8
(Your kisses and your passion)

Chorus:
Donde voy, donde voy 9
(Where I go, Where I go)
Esperanza es mi destinacion 10
(Hope is my destination)
Solo estoy, solo estoy 11
(I'm alone, I'm alone)
Por el monte, profugo me voy 12
(Through the desert, a fugitive, I go)
Dias, semanas, y meses 13
(Days, weeks and months)
Pasa muy lejos de ti 14
(Pass far away from you)
Muy pronto te llega un dinero 15
(Soon you'll receive some money)
Yo te quiero tener junto a mi 16
(I want to have you near me)
El trabajo me llena las horas 17
(Work fills my hours)
Tu risa no puedo olividar 18
(Your laughter I can't forget)
Vivir sin tu amor no es vida 19
(To live without your love isn't living)
Vivir de profugo es igual 20
(To live as a fugitive is the same)

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West Side of Town (from "Homeland" by Tish Hinojosa)

Felipe was a young boy when he crossed the Rio Grande
Headin' north to Texas where he grew into a man
He fixed cars and worked the wars and raised a family
San Antonio was home on the West Side of Town
Young Maria dreamed of singin' in a concert hall
Past the plaza and the village church adobe wall
Hard times stole her innocence but drove the woman's heart
San Antonio bound to the West Side of Town

Chorus:
She was proud and lived on faith
He was strong in his own way
They were pilgrims that made
A good life the hard way

Felipe lost his first wife in 1943
Seven growing children and desperately in need
Maria came to look for work and found her destiny
With one child of her own to the West Side of Town
They were married years went by and now we were thirteen
Days were good and days were bad but mostly they were lean
Schools and shoes and food and books believin' in a prayer
God must know his way 'round on the West Side of Town

Chorus:
We would go to Mexico and Mama she would cry
For the things we'll never know she had to leave behind
Sisters, brothers know too well what memories can do
Climbin' up when you're down from the West Side of Town
Daddy never owned a house but built a strong foundation
Mama bought her own damn house with self determination
They're both gone but I know that they're listening to this song
'Neath the San Fernando ground on the West Side of Town

Chorus (Last Chorus)
Peregrimos de ayer
(Pilgrims from yesterday)
Del Destino y la fe
(Through destiny and faith)
They were pilgrims that made
A good life the hard way.

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Questions for "Joaquin":

In the song, "Joaquin," what were some of the push and pull factors that led Joaquin to leave his homeland for a new beginning in a new country? List specifically, the lines that deal with a push/pull factor, and explain the factor.

Do you feel Joaquin's decision to migrate was done in haste? Explain.

Reread lines 21 through 30. Explain what those lines mean.

Questions for "*Donde Voy*":

Compare *"Donde Voy"* and "Joaquin." What feelings are the songs trying to convey to the listener? Explain.

Assume Joaquin's migration begins in San Luis Potosí (22° N, 101° W) and ends in San Antonio. Using an atlas, list the problems an illegal immigrant may encounter on this trek for a better life? What types of physical barriers (natural and built) will Joaquin have to deal with?

List specific lines from the songs that express some of these problems. In your opinion, do you think the trek is worth it? Why?

Questions for "West Side of Town":

In the song West Side of Town, a Hispanic family grows up in the west side of San Antonio. Describe the life style of this family (family structure, work ethic, etc.). List specifically the lines that support your description. *In your opinion*, do you think the move from Mexico was worth it? Why?

Explain some of the similarities and differences between this family and your family.

3 Circling San Antonio

Dagoberto Eli Ramirez

Introduction:

Many people recognize The Alamo as the symbol of San Antonio. The city's nickname (The Alamo City), the famous battle cry (Remember the Alamo!), and the newest sports arena (the Alamodome) all attest to this fact. This lesson takes the fame of that name and uses it as the focal point of a geographical excursion through the five Spanish missions, the river, and five creeks that are located in San Antonio.

Grade Level: Grades 7-8

Time Required: 2 hours

National Geography Standards*: (appropriate pages cited for standards, grades 5-8)

1. How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective. 144-145
3. How to analyze the spatial organization of people, places, and the environments on Earth's surface. 148-149
4. The physical and human characteristics of places. 150-151

**Geography for Life: National Geography Standards*. 1994. Washington, D.C.: National Geographic Research and Exploration. (See also Chapter 3 for Skills and Perspectives.).

Objectives:

- Students will locate San Antonio, the Alamo, Mission Concepción, Mission San Jose, Mission San Juan Capistrano, Mission La Espada, the San Antonio River, Salado Creek, Olmos Creek, Apache Creek, Zarzamora Creek, and Leon Creek on a map of the San Antonio area
- Students will draw sketch maps
- Students will calculate distance
- Students will explain the location of the missions
- Students will compare past and present San Antonio

Materials:

- Official "Highway Travel Map" of Texas (available from the Texas Department of Transportation in Austin, Texas).
- Maps, brochures, pamphlets, and books about Texas and San Antonio. (You can obtain free and inexpensive materials by writing to the San Antonio Chamber of Commerce in San Antonio, Texas, and the Texas Department of Transportation in Austin, Texas. You can also obtain numerous commercial publications through local (central Texas) resource centers and bookstores.)
- Blank paper for sketch maps

The Learning Activity:

- *Executing the Activity:*

Have the students locate the United States on a world map, Texas on a map of the United States, and San Antonio on the "Official Highway Travel Map" of Texas. Give them some background on the physical, political, and cultural features of the area (See Chapters 1-7). Then, using the inset map of San Antonio on the back of the "Official Highway Travel Map" of Texas, along with the worksheets provided, have students complete the following activities:

Activity One: Mapping San Antonio?

Using the alphanumeric grid system and the scale corresponding to the inset map of San Antonio (along with the various symbols and design characteristics in the legend included in the

"Official Highway Travel Map of Texas") answer the following items that should help you become initially acquainted with San Antonio, Texas and the surrounding area.

What major interstate highways go through the city?

What U.S and State highways go to the city or through the city?

Name the two major highway loops that seem to encircle the city.

Looking at the area considered to be inside the city limits, and using the scale provided, what is San Antonio's approximate area in square miles or square kilometers? (Use geometrical formulas)

Name the military installations located in and around the city. Also, list their approximate locations by using the alphanumeric grid.

Five Spanish missions date back to the 1700s in San Antonio, and they are located on the map. Starting with the northernmost one and proceeding southward, list all five, with their alphanumeric locations on the map.

One river and five major creeks run through the city. List them.

Using only the information gathered in this activity, and without tracing any part of the map used, create your own map of San Antonio. Use a clean sheet of paper provided by your teacher. Be as accurate and creative as possible. Give your map a title and an approximate scale.

Activity Two: So what if it's there?

The Spanish built the missions before the city of San Antonio. Try to imagine what that would have been like, and make a list of things that you would expect to find in a modern city that would not have existed when the missions were built. How would the mission inhabitants have compensated during this period?

The missions are all located close to the San Antonio River. Why was the river so important?

Using Fig. 5.2 from Chapter 5, locate the northernmost and southernmost missions on the map and using the scale and the edge of a piece of paper, measure, calculate, and state the distance between them. How long would it have taken a person to travel that distance in the early 1800s and how long today? (Before asking students to do this, raise questions about modes of transportation, speed, and whether the route would be measured *as the crow flies*. Expect no right answer to this problem and encourage students to give their reasons for their responses.)

- *Evaluation:*

Students will be evaluated on the quality of the reasoning shown in the completion of the activities.

Extension:

- Provide students with information on the mission era and present day San Antonio, or have them do the research. Have them compare past and present San Antonio according to population size, economic activity, trading links, and ethnic balance.

4

New Braunfels: Reflections on a Tin Roof City

JoBeth Oestreich

Introduction:

This lesson examines the historical and cultural imprint that German immigration has made in Texas, using the city of New Braunfels as a case study.

Grade Level: Grades 7-10

Time Required: 2 to 4 class periods

National Geography Standards*: (appropriate pages cited for the standards, grades 5-8 and 9-12)

1. How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective. 144-145; 184-185
2. The physical and human characteristics of places. 150-151; 190-191
6. How culture and experience influence people's perceptions of places and regions. 154-155; 195-196
9. The characteristics, distribution, and migration of human populations on Earth's surface. 160-161; 201-202
12. The processes, patterns, and functions of human settlement. 167-168; 208-209

**Geography for Life: National Geography Standards*. 1994. Washington, D.C.: National Geographic Research and Exploration.

Vocabulary:

fachwerk, emigrant, immigrant, land tract, Prince Carl of Solms, Society for the Protection of German Immigrants

Objectives:

- Students will trace the route taken by the German colonists to come to Texas.
- Students will discuss why Germans were willing to immigrate to Texas.
- Students will discuss the problems faced by the Germans who immigrated to Texas.
- Students will discuss why New Braunfels is known as the "tin roof city."

Materials and Resources:

- Map of Texas
- Map of the world
- Letter by New Braunfels colonist Herbert Lux (provided)
- Haas, Oscar. 1968. *History of New Braunfels and Comal County Texas: 1844-1946*. Austin, Tex.: The Steck Co.
- Chapters 2 and 7 of this site guide.

The Learning Activity:

- *Introducing the Activity*

It is necessary to provide an historical overview of the founding of New Braunfels. In 1842, the Society for the Protection of German Immigrants was formed in Germany. It consisted of twenty-four German noblemen, whose goal was to establish German colonies in Texas. The economic reason was to secure trade with the independent Republic of Texas. Each nobleman contributed $80,000. The Society charged each German family $240 willing to go to Texas in exchange for transportation, 320 acres (144 hectares) of land, and supplies and provisions until the first harvest.

In June of 1844, Henry Fisher traveled to Germany to sell Texas land. He closed a deal for $9,000 for a 4-million-acre (1.8 million-hectare) tract located between the Llano River and the Colorado River. The German Society purchased the land sight-unseen.

Prince Carl of Solms, a member of the Society, traveled to Texas in July of 1844 to establish the new colony. After arriving in Texas and covering more than 250 miles of difficult terrain, he arrived at the Fisher Tract. The area was isolated from Austin and San Antonio. The rocky soil was prohibitive for farming, and the area was still under Comanche control.

Meanwhile, late in 1844, three ships carrying German colonists sailed into Galveston and then on to Indianola, a port community [about 90 miles (145 km.) southwest of Galveston and 80 miles (129 km. northeast of Corpus Christi] established by Prince Solms. (Indianola soon became the second-most important port in Texas. Unfortunately, in the 1880s, it was wiped out by hurricanes and never rebuilt.) By December of 1844, 439 Germans had emigrated to Texas. After negotiations took place, Prince Solms was able to purchase 1,265 acres (513 hectares) from Rafael L. Garza and his wife Maria Antonia Veramendi Garza for about $1,100. This tract was located near the Comal and Guadalupe rivers, northeast of San Antonio.

On March 21, 1845, the settlers crossed the Guadalupe and founded New Braunfels. The town was named for Braunfels (the German term for brown rocks), the hometown of Prince Solms in Germany. Land titles were drawn in half-acre (0.21-hectare) town lots and ten-acre (4.1-hectare) farm lots. Because of the threat of Indian attacks, two cannons were shot and a mounted patrol sent out every night. Needless to say, the colonists had few problems with the Indians because of these precautions.

After founding the town, Prince Solms handed control to John Meusebach. Prince Solms returned to Germany in May 1845 to wed Lady Sophia. He never returned.

New Braunfels did not prosper initially. The colonists grew impatient with the promises of supplies, housing, and land. The extremes of climate affected their health. One in five of the immigrants died the first year.

By 1847, the German Society lost interest in Texas. During this time, however, 30,000 more Germans came to Texas. By 1850, New Braunfels was the fourth-largest city in Texas. The Germans made many contributions to Texas. They introduced new staple crops. They used limestone and timber to construct their buildings. They used *fachwerk* (half-timber method) for constructing these buildings. The Germans introduced music (such as the polka), singing, marksmanship, public education (New Braunfels was the first community in the Texas to tax its citizens to pay for schools; Austin followed its lead later on), religion, beer, sausage, and bowling to Texas.

New Braunfels is known as the "tin roof city" because the city council passed an ordinance requiring all roofs to be made of tin for the new fire code regulations. Fires had become commonplace, as more and more people were able to cook inside their homes with cast-iron stoves bought in San Antonio. The story has been told that a prominent member of the council owned the only hardware store in town that sold tin, and was able to profit nicely from this new ordinance. Whether this was intentional or merely a coincidence remains unknown.

- *Executing the Activity:*

Refer students to a world map and have them locate Germany and Texas, and estimate the distance between Germany and the southeast coastline of Texas. Students will then determine how many miles the first colonists had to travel to reach their final destination. (Remember, once they landed at Indianola, they had to travel by covered wagon to New Braunfels. Remember also to point out that Texas was in the midst of a war with Mexico. It became difficult for new arrivals to be directed to New Braunfels and other German towns being established because of Indian- and war-related problems.) Next, have students look at a map of Texas and estimate the distance from Indianola to New Braunfels. Identify and locate other

German settlements in Texas. Have students read the letter by Hubert Lux. Ask the students the following questions:

- How did the climate affect Hubert Lux?
- What did Hubert Lux mean when he said, "We are quite content and happy"?
- Finally, ask students to recall the difficulties the colonists experienced. Ask them to relate the colonizing of Texas by the Germans to any other colonizing that took place in the Republic of Texas or the United States. Have them explain what they have learned from this lesson.

- *Evaluation:*

Have the students write a letter home, as if they were German colonists explaining their journey to Texas.

Handout 4.1: A letter from New Braunfels colonist, Herbert Lux, in the 1840s.

New Braunfels, May 1, 1845

My Dear Uncle,

Today I will let you know about our present, and past situation. We made the voyage from Europe to America in fifty days fortunately without any mishap and sickness. At the sea near Cuba a baby daughter, Maria Anna, was born to us. At Galveston we had her baptized in the Catholic Church. The Franke Family with two other families decided to stay in Galveston. The remainder of us sailed by schooner to Port Lavaca in four days. From there we went to San Antonio de Bexar. Since we arrived during the hottest season of the year all of us except Schonen from Selgersdorf became sick. My wife and I had to struggle four weeks with fever. The reason was because we landed on the coast in the hot season when fever prevails and is unhealthy there. We brought the fever with us. All immigrants who arrive in the summer get the fever. Those who come in the winter stay in good health. I therefore advise that immigrants should not come in Summer, but leave the old Country in September, being the better time. Our little Anna Maria died in San Antonio at age of 3 1/2 months and was buried by a German Catholic Priest.

We did not get to the Castroville Colony but joined the German Nobleman's Association of which you no doubt have heard. On March 21st we arrived at our present dwelling place. Prince Solms who was sent by the Association, has here founded a town site which shall soon be built up. The Prince gave each single man over 17 years of age and each head of a family 10 acres of land and a half-acre town lot for a home and a garden. We get the 320 acres later. I think that with the 10 acres which according to the Prussian measurement amounts to 15 Morgan, I will have all that I can cultivate. We do not have to provide feed for cattle. We now have two cows with calves, a yoke of oxen, 20 chickens. Hogs have not yet been delivered here. Cattle find their own feed in winter as well as in summer. When the cows come home in the evening which they do by themselves, they are penned and milked. They are kept in the pen overnight, milked again the next morning, and turned out into the prairie.

Products of the land here are: Tobacco, cotton, sugarcane, cacao bean, corn, wheat, potatoes, and garden vegetables.

We are now quite content and happy. When one gets adjusted, that is, has his house finished, field fenced, and wants to use a third of his time (to?) go working, which in Europe one has to, it is better living here, than that of a farmer in Europe. I have no desire to ever go back, whoever wants to see me must come here; I do not believe that he will regret it.

Whoever wants to come would do well to bring iron, copper, and tin house and kitchen utensils, spade and hoes, pan for cleaning fruits and a plow since the Germans do not get along well with the domestic plows which for breaking the raw land are not as good as the German Plows. Also a plow-line and some rope. Whoever can bring a pair of wheels for a cart, does well, also a grind stone. Bring garden seeds of all varieties. Also wheat, especially summer wheat, the variety is not readily available here, besides is planted in the right method only by the German farmers. Whoever comes must never allow himself to be detained on the coast by Americans or Germans who being too lazy to work have fallen victims to drunkenness or lead some other dissolute life. But come up here at once where fever and other sickness never occur.

I close my letter with hopes that it shall find you in the same good health in which it leaves me, and with kindest regards to you, dear Uncle, and to all relatives and friends, in particular the Mr. Pastor Minterjahn of Hombach, many thousands times and wish a long healthy life. In all, the same from my dear wife.

(signed) Herbert Lux

Translation from: Oscar Haas. 1968. The History of New Braunfels and Comal County, Texas 1844-1946. The Steck Company, Austin, Texas. pp. 30-31

5 Enchanted Rock: An Outdoor Classroom

Martha O. Bock and Frederick M. Bock

Introduction:

This lesson is a description of a field trip to Enchanted Rock State Natural Area. The purpose of this activity is to demonstrate how teachers can include field experiences in a secondary-school geography program. Enchanted Rock is one of the largest granite exfoliation domes in the country, second in size only to Stone Mountain in Georgia. Its nearly barren surface rises more than 400 feet (122 meters) above the surrounding terrain. It is located approximately 25 miles (40.3 kilometers) north of Fredericksburg, Texas, at the northern edge of the Texas German Hill Country region (about a two-hour drive northwest of San Antonio.)

Grade Level: Grades 9-12

Time Required: Two days (one in class, and one for trip itself)

National Geography Standards*: (appropriate page numbers cited for standards, grades 9-12)

1. How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective. 184-185
4. The physical and human characteristics of places. 190-191
7. The physical processes that shape the patterns of Earth's surface. 197-198
14. How human actions modify the physical environment. 212-213
17. How to apply geography to interpret the present and plan for the future. 221-222

**Geography for Life: National Geography Standards*. 1994. Washington, D.C.: National Geographic Research and Exploration.

Vocabulary:

granitic rocks, metamorphic rocks, igneous rocks, erosion, intrusion, batholith, uplift, magma, dike, exfoliation dome

Objectives:

- Students will explain how the landscape of Enchanted Rock developed.
- Students will evaluate the effects of erosion and weathering.
- Students will describe patterns of land use in the surrounding area.
- Students will use the skills of reading a topographical map, a highway map, and a city map.
- Students will prepare a photo essay (or similar assignment) to document the field-trip experience.

Materials and Resources:

- Road map of Texas
- Map of Major Physical Regions of Texas (provided, Figure 3.1 from Petersen in this guide): Source: Reese, James V. and Kennamer, Lorrin. 1978, *Texas: Land of Contrast*. Austin: W. S. Benson & Company, p. 44. Drawn by Walt Harris Jr.
- Chapter 3 in this site guide
- Enchanted Rock Field Trip worksheet (provided)
- Rock and Landform Identification checklist (provided)
- State Natural Area map of Enchanted Rock Trails
- Field guide: Petersen, James F. 1984. *Enchanted Rock State Natural Area: A Guide to the Landforms*. San Marcos, Texas: Terra Cognita Press.

The Learning Activity:

- *Background:*

Enchanted Rock State Natural Area is unique in Texas because of its geological composition, geographic location, and its visual impact on the visitor. It provides a unique outdoor laboratory in which teachers can demonstrate, reinforce, and test instruction in geography, geology, topography, cartography, and social sciences.

The field trip provides a model for a student field experience using Enchanted Rock as the locale and geography as the primary discipline from which the content is drawn. Emphasis is on the location and geologic character of Enchanted Rock State Natural Area within the major surrounding geologic zones. Geologic history and composition of the domes in the area are important topics for study. The area provides an excellent place to study landforms as well as chemical and mechanical weathering. The process of plant succession is also evident in the weathering pans atop the dome. The unobstructed views and rugged relief provide a dramatic setting within which to study the use and relationships among topographic and geological maps, the surrounding terrain, and energy cost of foot travel relative to gradient and route. Other fertile opportunities for investigation include the archaeological history of the area, the history of the State Natural Area, and issues of land use and park management.

- *Planning the Itinerary:*

Using Petersen's guide, and other information about Enchanted Rock, plan the exact trip itinerary (both bus and hiking portions). Include in the itinerary the learning activities each student team will conduct. Test-run your itinerary prior to the trip.

- *Preparation:*

In the classroom, divide the class into teams of four students.

-Distribute the map entitled, "Major Physical Regions of Texas," and have teams study the map and locate the Edwards Plateau, the Balcones Escarpment, and the Coastal Plain. Have students locate San Antonio and Enchanted Rock (circled).

-Distribute road maps of Texas, and have teams plot the route from San Antonio (or from other points of origin) to Enchanted Rock. Have students calculate the distance and travel time from San Antonio (or from other points of origin) to Enchanted Rock.

-Distribute the park map of Enchanted Rock Trails, and have teams study the map and identify the major hiking trails. Have students locate the Summit Trail and the summit of Enchanted Rock dome.

-Distribute the list of questions for the Enchanted Rock Field Trip and a copy of Petersen's Guide to the Landforms. Using the guide, have teams answer the questions on the worksheet. Discuss the answers to the questions.

-Distribute the Rock and Landform Identification Checklist. Show slides or pictures illustrating the terms on the checklist. Discuss the characteristics of each term and have students make notes on the handout.

-Have each group elect a photographer and decide on a group project to present to the class after completing the field trip. (Suggestions: photo essay, short story, poem, history of the creation of Enchanted Rock State Natural Area.)

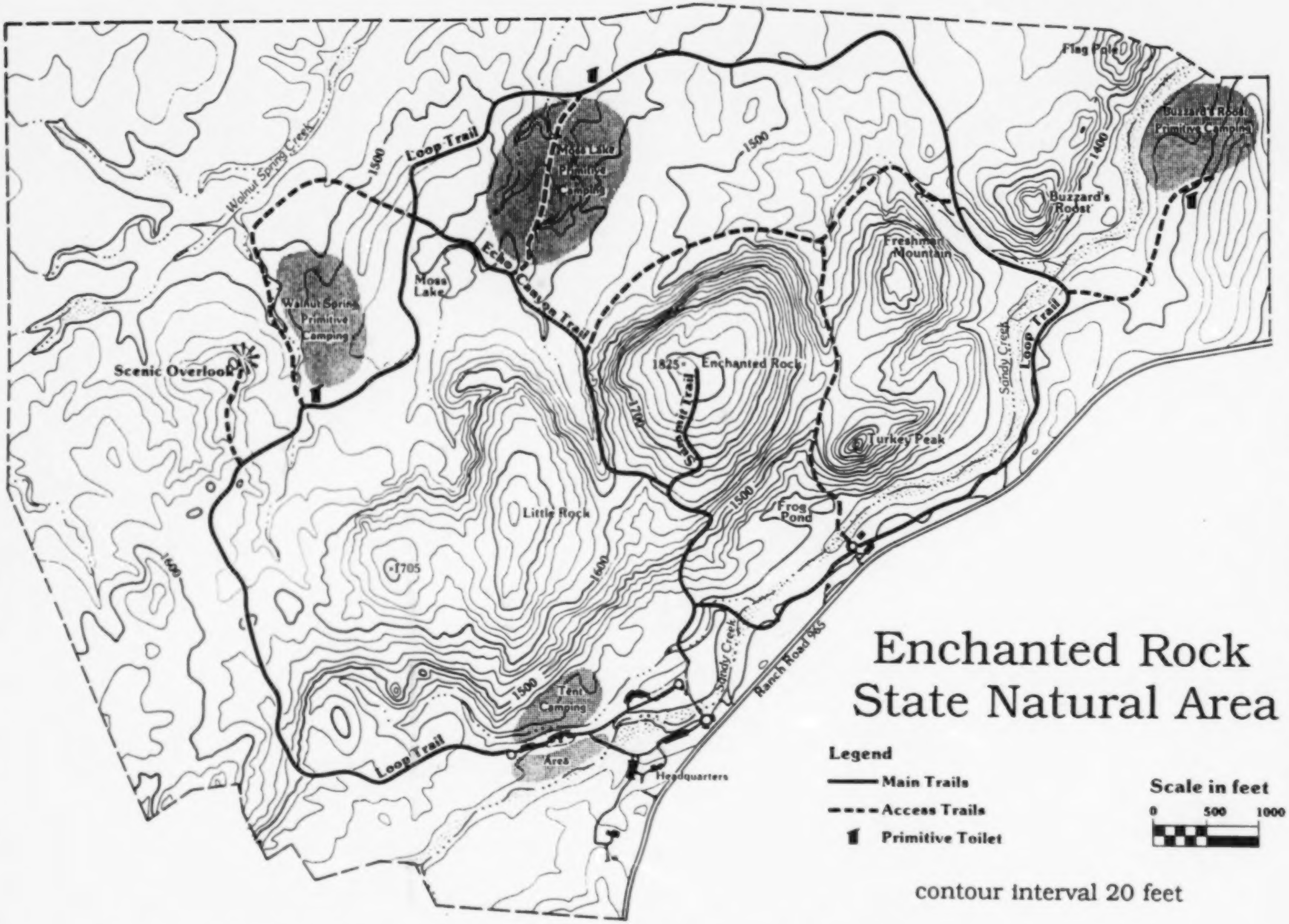
- *Conducting the Field Trip:*

Review the field trip itinerary and procedures with the students. In the field, repeat the learning activities already completed in the classroom to verify the results. In particular, make sure the students can identify the landforms, environmental features, and other area characteristics presented during the pre-trip learning activities. Conduct any additional activities described in the itinerary.

- *Evaluation:*

In class, have each team of four present its group project. Include questions about each of the learning activities before and during the field trip in a graded evaluation activity.

Handout 5.1: Map of Enchanted Rock State Natural Area



Source: Petersen, James F. 1984, 1988. San Marcos, Tex.: Terra Cognita Press: 28-29 Courtesy: Texas Parks and Wildlife Department.

BEST COPY AVAILABLE

Instructions to each team:

Using the Enchanted Rock Landform field guide, answer as many questions in this handout as you can. Bring a copy of the completed handout with you on the field trip.

On the day of the field trip, be prepared to finish the handout and discuss these questions.

Questions:

What kind of rock is granite?

Enchanted Rock is composed of a coarsely, crystalline pink granitic rock called

___________________________________.

How has the rock seen at Enchanted Rock been exposed?

Of what four silicate minerals is Town Mountain Granite formed?

Which mineral gives Enchanted Rock its pink tone?

What are the two types of weathering?

What is the age of Enchanted Rock?

What is the approximate age of the rock of which its composed?

What causes the strange noises that come from the rock?

How is the ecology of Enchanted Rock different from the surrounding area? How is it alike?

What evidence can you give to illustrate how fragile the environment is?

What are some consequences of the destruction of that environment?

Why has Enchanted Rock been designated a State Natural Area? Do you agree or disagree with this designation? Why or why not?

Check List for Rock and Landform Identification:

Write a short description next to each feature.

xenolith: ______________________________

dikes: ______________________________

fine-grained (aplite): ______________________________

coarse-grained (pegmatite): ______________________________

crystalline microrelief: ______________________________

grus: ______________________________

joints/joint sets: ______________________________

exfoliation sheets: ______________________________

exfoliation dome: ______________________________

tent blisters: ______________________________

tors: ______________________________

castle tors: ______________________________

rock pedestals (mushroom rocks): ______________________________

tafoni: ______________________________

cavernous weathering: ______________________________

weathering pits/pans: ______________________________

rock doughnuts: ______________________________

rills: ______________________________

The Battle over Dolphin Bay

Linda L. Hammon

6

Introduction:

Students will describe and evaluate competing uses for barrier islands. Through role-playing, they will develop some steps that could be taken to help make a decision about whether or not to develop a barrier island.

Grade Level: Grades 6-12

Time Required: 3 days

National Geography Standards*: (appropriate pages cited for standards, grades 5-8 and 9-12)

4. The physical and human characteristics of places. 150-151; 190-191
7. The physical processes that shape the patterns of Earth's surface. 156-157; 197-198
13. How the forces of cooperation and conflict among people influence the division and control of Earth's surface. 169-170; 210-211
14. How human actions modify the physical environment. 171-172; 212-213
15. How physical systems affect human systems. 173-175; 214-215
16. How to apply geography to interpret the present and plan for the future. 181-182; 221-222

**Geography for Life: National Geography Standards*. 1994. Washington, D.C.: National Geographic Research and Exploration.

Objectives:

- Students will explain the ways in which people and wildlife depend on and use coastal areas.
- Students will locate barrier islands and list the reasons why they should be protected.
- Students will evaluate advantages and disadvantages for a community to develop a barrier island.
- Students will develop workable compromises.

Materials and Resources:

- "Gift of the Sea" handout (provided)
- Map of Texas showing barrier islands (provided)
- Newspaper article (provided)
- Discussion questions with answers (provided)
- Poster boards
- Markers
- 3-by-5-inch index cards

Optional:

- Hard hat for the developers
- Bell for the panel to call the room to order

Additional Resources:

- Mitchell, John G. 1992. "Our Disappearing Wetlands." *National Geographic Magazine* (October): 3-45.
- Lee, Douglas Bennett. 1992. "America's Third Coast." *National Geographic Magazine* (July): 3-37.
- *Conserving America: The Challenge on the Coast*. PBS television special.

- Benhart, John E. and Alex Margin. 1994. *Wetlands: Science, Politics, and Geographical Relationships*. Pathways in Geography Publication, No. 9. Indiana Pa.: National Council for Geographic Education.

The Learning Activity:

- *Background:*

Scientists estimate that by the mid-1990s, three out of four people in the United States will live within 50 miles of a coast. With so many people wanting to live in coastal areas, tremendous pressure is building to construct more houses, resorts, and other facilities to accommodate the projected human influx.

Unfortunately, coasts and development usually do not make a good match. The main problem stems from the natural instability of coasts. All coasts are constantly changing because of the action of wind, waves, and tides, and that makes building on coasts (whether on a barrier island, sea cliff, or dune) extremely precarious. Development projects often mean added problems for coastal habitats, among which include increasing pollution, increasing erosion, disrupting plant and animal life, and over-harvesting coastal resources.

- *Introducing the activity:*

Ask the students to think about some ways that people and wildlife depend on and use coastal areas. Remind them that coastal areas include sandy beaches, coastal wetlands, rocky shores, barrier islands, and other types of habitats. (People use coasts for a variety of recreational activities, including swimming, birding, sport fishing, and so on.

People also depend on coastal areas for many resources, including fish, shellfish, seaweed, minerals, and oil. Many species of wildlife live in coastal waters, on sandy and rocky beaches, in dune areas, and in low-lying wetlands. Coastal wetlands also help trap pollutants and prevent flooding. Many species also nest in and migrate to coastal areas.

Next, ask the students to think of some ways that people's use of coastal areas may cause problems. (People create pollution, over-fish, destroy wildlife habitats, increase erosion, and so on.)

- *Executing the activity:*

Have students read and discuss "The Gift of the Sea." Then, give the students the following scenario:

-Communities in many coastal areas are faced with the dilemma of deciding whether to develop nearby barrier islands and coastal areas. In trying to decide what to do, citizens and government officials must weigh a variety of factors, including environmental impacts, economic realities, and wildlife needs. You will be discussing a proposed development plan in Texas. Although the example is fictional, it is based on real-life issues. You will be focusing on several coastal towns in Texas that are trying to decide whether to allow developers to build a resort community on a nearby barrier island.

Display the map of the Texas coast and have the students point out the barrier islands. Pass out the newspaper article and have each student read about the proposed development plan.

The next day, divide the class into groups of four or five, with one group composed of three individuals. Assign this group of three the roles of congressperson, county commissioner, and university professor. Using the list of discussion questions provided (write the questions on the board or project them on a overhead transparency), have students discuss their thoughts and answers to the questions. Then, using the cards with either the word "Developer" or "Environmentalist" written on them, have one member from each group draw a card at random. The groups are now to investigate materials for and develop their arguments from the viewpoint of whichever card they drew. The teacher will need to walk around and work with each group to encourage good points of discussion or debate. Next, give each group a poster board.

-If the group is representing the developer viewpoint, have them draw a master plan of the island, showing how it will be developed. Have them also design a logo for their company. They must take into account traffic, habitat destruction, home sites, waste removal, and other pertinent factors. They will use this master plan for presenting their case.

-If the group is representing the environmentalist viewpoint, have them develop a plan for protecting the coastal environment. They may also make signs with slogans and pictures that support their plan for display at the meeting when presenting their case. Advise students that making signs or slogans for display at a meeting should not stereotype environmentalists as slogan-making or poster-carrying individuals, but as individuals who have carefully investigated data and prepared reasoned arguments to support their positions.

-The group with the congressperson, professor, and county commissioner will be developing questions to ask each side. This panel will decide whether the island should be developed. The teacher may want to help them get started by giving them examples of the type of questions they need to ask.

On the third day, give the groups about ten minutes to organize their discussion. Place the group of three at the front of the room in panel fashion. Have the other groups in clusters. Each group will present its proposals (both pros and cons). Encourage each person to lead at least one discussion question or answer. Remind the groups that they must come up with a workable compromise. The panel will ask questions to each of the groups about the proposed development. When everyone has finished their presentations, have the panel make its decision. Write down the strong points of the discussion on an overhead transparency or chalkboard. Evaluate with the class the viable options for each group.

- *Evaluation:*

Have students support, orally or in written form, the opinions and arguments they present. Use a checklist to make a written evaluation of students' work. Presentation, group work, graphics or artwork, and content can each be worth 25 points, for a total of 100 points.

Extensions:

- Have each group investigate a current coastal problem. Has the problem been resolved? If so, how? If not, why not?
- Make a coastal issues bulletin board. The students need to bring to class articles relating to coastal development, pollution habitat destruction, and other topics.
- Each group could investigate a threatened or endangered species that lives on or near barrier islands.
- Have students read the quote by Rachel Carson at the beginning of "The Edge of the Sea": "The edge of the sea is a strange and beautiful place." Have the students write in their journals what Rachel Carson's quote means, and then have a class discussion about the different perspectives.

Handout 6.1: "Gift from the Sea"

"The edge of the sea is a strange and beautiful place."
-Rachel Carson, *The Edge of the Sea*. 1955. Signet Science Library. New York: Signet.

The United States boast thousands of miles of coast-enough shoreline to wrap around the earth more than three-and-a-half times. Along these coastal stretches, waves, wind, and land interact to create a dazzling variety of environments. In parts of Washington state, for example, mighty cliffs shoulder the Pacific. In southern California, a sandy beach gently slopes into the sea. Near the tip of Florida, a mangrove swamp reaches into the warm waters of the Gulf of Mexico. Jagged rocks border the Atlantic on the coast of Maine.

Coastal Dynamics

On the move: Whether they're rocky, sandy, or marshy, coasts have one thing in common, they are always changing. Every day, tides alternately cover and uncover the shore. Waves constantly crash against the coast, gradually reshaping it as they wear away rocks and pick up or deposit sand and other sediment.

The effect of tides and waves on the shore is intensified during storms. When storm waves hit a sandy beach, for example, they cut into the beach, carrying away much of the sand and depositing some of it offshore. After the storm, gentler waves may gradually pick up sand from offshore and dump it on the beach, and the beach slowly builds up again.

Dig Those Dunes: Dunes form an integral part of the sandy beach environment. (Dunes form as wind blows dry sand off the beach, creating piles of sand behind the beach.) During a heavy storm, these piles of sand help break the force of waves that might otherwise sweep further inland. And after the storm, they provide a reservoir of sand for the beach. Wind and waves move sand from the dunes onto the beach, helping to replace some of the sand that was removed in the storm.

Rivers of Sand: Waves do more than move sand back and forth from the shore. They also create "longshore currents" that flow essentially parallel to the shoreline and move sand along the coast. Along some beaches, the amount of sand moved by longshore current in one day would fill more than 250 dump trucks.

What happens to all this moving sand? In certain areas along the coast, such as near rocky outcroppings, inlets, and the ends of islands, longshore currents are interrupted and drop some of their sand load. Much of the sand settles in sand bars close to land, where waves can carry it onto the shore.

A Coastal System: "Erosion" (the loosening and carrying away of sand, rocks, and other material) and "accretion" (the buildup of these materials) are both part of the natural process of coastal change. As one coastal area is depleted, another is built up. In some areas, for example, longshore currents may carry bits of rock from an eroding rocky cliff to a sandy beach miles away. Currents also pick up and carry sediment that has been deposited in the ocean by rivers and streams. This continual transfer of material from one coastal area to another is what keeps a sandy beach built up.

Ups and Downs: Coasts are also affected by changes in sea level. Over geologic time, the sea level has risen and fallen by hundreds of feet. During the past century, the sea level has risen by about one foot. Today, it is rising faster. This rising sea level is increasing the rate of coastal erosion in many areas, especially on barrier islands, which lie just off the coast.

Trouble On the Shores

Fighting Changes: For many people, living on or near the coast is a lifelong dream. But construction on the shore inevitably puts people at odds with the natural processes of coastal change. For example, if a house is built on dunes, it can block the movement of sand from dunes to beach. Without sand from the dunes to help replenish it after storms, the beach will become narrower and more vulnerable to storm damage.

To keep coastal areas intact and protect development, engineers have tried a variety of strategies. Unfortunately, most of these *stabilizing* techniques are expensive, short-term solutions that create more problems than they solve. For example, engineers have tried to replenish certain beaches by dredging sand from other areas and dumping it on the eroding beach. But dredging sand from offshore areas disturbs or destroys the animals that live in these areas. And the "new" sand often doesn't last more than a few years before it is washed away by storm waves. Despite these problems, some people consider beach replenishment to be one of the less harmful ways to protect coastal development.

Say Good-bye to Habitats: Besides interfering with natural coastal processes, development often destroys wetlands and other important habitats. Already, more than half of the coastal wetlands in the United States have been destroyed. Because these saltwater marshes and mangrove swamps serve as nurseries for over 80 percent of the commercial fish and shellfish species in the United States, as well as important stopovers for migratory birds, the destruction of coastal wetlands has hurt many species, not to mention the fishing industry. Development can also disturb coastal areas where seals and sea lions breed, shorebirds nest, and sea turtles lay their eggs.

Toxic Tides: Too many people on or near the coast have created another serious problem: coastal pollution. In the last fifty years, the amount of pollution and the toxicity of pollutants in the ocean have increased dramatically. Here is a closer look at the reasons for coastal pollution.

Debris in the Sea: Each year, more than 14 billion pounds of garbage are dumped into the world's oceans. This trash comes from many sources, including manufacturing plants, commercial, military, and recreational vessels, overflowing landfills along coastal areas, and people who illegally dispose of medical waste at sea. Besides creating an ugly mess as it washes up on beaches, some types of garbage can harm or kill wildlife. For example, more than two million seabirds and 100,000 mammals, along with countless other animals, die each year after eating or becoming entangled in plastic.

An Oily Problem: Oil pollution also affects the quality of coastal waters and the life in these waters. Although a damaged oil tanker or offshore rig can spill millions of gallons of oil, much of the oil in coastal waters comes from city streets and other land-based sources.

Deadly Discharges: Some coastal areas can be dangerous to your health, not to mention the health of fish and other animals. Many factories and sewage-treatment plants often discharge wastes directly into coastal waters. These wastes often contain hazardous chemicals that can build up in the bodies of fish, shellfish, and other creatures. Sewage also acts as a super fertilizer, promoting the growth of algae. The algae use a lot of the water's oxygen, causing fish and other animals to suffocate.

We All Live Downstream: Even the actions of people who live hundreds of miles from the coast can have a significant effect on coastal water quality. That is because water that runs off driveways, roads, lawns, and gardens ends up in rivers and streams that eventually empty into the ocean. This polluted water, collectively called *runoff*, contains traces of pesticides, fertilizers, oil, antifreeze, gasoline, paints, and other chemicals. And each of these ingredients has an effect on water quality.

Hope For the Coast

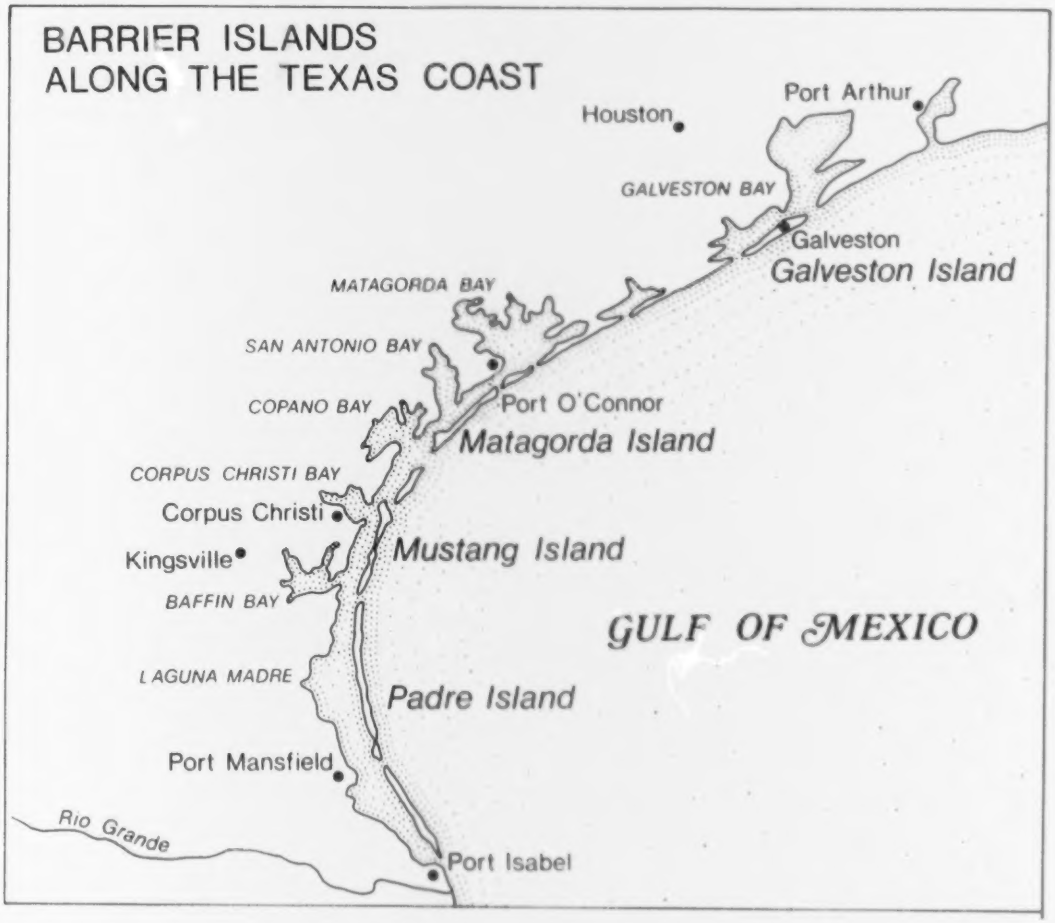
Making a Change: Despite the many problems facing our coasts, there is hope for the future. Some states, for example, have passed laws to restrict unwise development on their coasts. In North Carolina, *setback laws* now require that all large buildings must be set back from the shore at a distance that is equal to sixty times the annual erosion rate. On the national level, Congress recently re-authorized the Clean Water Act, which in part requires that the discharge from factories and sewage-treatment plants meet certain standards before being released in coastal waters. There is also hope that international cooperation will help clean up coasts all around the world. In 1988, thirty-nine countries, including the United States, ratified an international treaty to restrict the dumping of plastic in the ocean.

A Group Effort: Of course, none of these laws will do much good without strong enforcement. In the past, many coastal protection laws have been ineffective because of a lack of funding and support. Conservation groups (such as the National Wildlife Federation, the Center for Marine Conservation, and the Oceanic Society) are working to strengthen and enforce existing laws and create new legislation. They are also helping to build support for coastal protection by teaching the public why our coasts are in trouble.

Taking the Plunge: All around the country, determined individuals are taking the initiative to clean up and protect their coastal areas. Through their efforts, they are drawing other people into the battle to save the coasts.

Source: Information gathered from a PBS television program titled *Conserving America, the Challenge on the Coast.*

Handout 6.2: Barrier Islands Along The Texas Coast



Handout 6.3: The Coastal News

Developers Battle Environmentalists in Coastal Debate

The battle is on. Developers of the proposed 15,000-acre Dolphin Bay resort on San Juan Island, Texas, said yesterday that despite opposition from citizens' groups, they intend to go ahead with their plans to build. The developers, the Cliffside Development Group, released a report last week, which claims the new resort would provide thousands of jobs for the economically depressed towns of Rosa, Ellis, and Fort Ward.

"This resort would do more for the people of Texas than anything we have done in the last 50 years," said Congressman John Williams. "People would have jobs, they would have a place to vacation, and they would be able to enjoy the wildlife on the island."

Others agree, saying that in addition to providing much-needed jobs, the resort would increase tourism and bring more money into local economies. And it would provide greater access to the island, allowing more of the population to experience the barrier-island habitat. As one long-time resident of Ellis said, "I'll finally be able to build the vacation home I've always dreamed about."

The entire project will take almost 18 years to complete. The three-part development plan will include the construction of a marina, a hotel, shops, a beach club, two nine-hole golf courses, a sewage-treatment plant, and several condominium and townhouse communities. A terminal, which will house two ferries to carry visitors and residents back and forth from the island to the mainland, is scheduled to be completed in the coming year. And a bridge linking the mainland to the island is expected to be completed within five years.

Despite the optimistic predictions from supporters of the development plan, many citizens, including environmentalists, scientists, and fishermen, feel the resort would eventually destroy the island and wreak havoc with the island's natural resources. As plans to go ahead with the project draw closer, several groups are launching anti-development campaigns.

"There are so many environmental flaws in the plan, it is hard to believe the state might actually go ahead with it," County Commissioner Diana Jones said in a public hearing last week. "I'm concerned about erosion from construction sites. I'm concerned about the destruction of prime wetland habitats. I'm concerned about pollution and over-fishing. But I'm most concerned about the long-term effects from over-development on a small, pristine barrier island...especially given that the sea level is expected to rise dramatically along the Texas coast by the year 2100. San Juan Island is currently the best thing Texas has got going, and it seems that we are willing to gamble it away on an iffy development scheme."

Anna Hernandez, a university professor, agreed. "We would definitely be wasting taxpayers' money by building a resort. Given our hurricane history and the nature of barrier islands, this resort just won't last. The island is continually eroding and moving, and the proposed development will only accelerate change."

In a recent fact sheet distributed by the Save San Juan Coalition, opponents point to several additional problems associated with the proposed resort, such as the loss of critical wildlife habitat and the probability that increased tourism will destroy dune vegetation, contribute to over-fishing, and create a litter problem. The fact sheet also points out specific areas that would be negatively affected by the development. For example, the construction of the marina and golf courses would destroy a major wetland drainage patterns in the 5,000-acre wildlife preserve that is located just east of the proposed resort. Runoff from the project could also have an impact on near-shore water quality, causing a decline in the productivity of the fisheries.

Environmentalists have been lobbying Congress to make San Juan Island part of the Coastal Barrier Resources System. If that happens, the developers would be unable to obtain federal financial assistance for building roads and power or sewer lines, and it would also prohibit them from receiving federally subsidized flood insurance.

"If a hurricane hit the island, Cliffside would lose everything if they don't get federal flood insurance," Jones explained. "But if they have tax-supported insurance, they don't care about the risks. They would build for the short-term gain and rebuild without losing a cent. Look at other communities that have tried to build on barrier islands. Disasters have been the norm. And you know who always ends up paying for the mistakes? The taxpayers and the wildlife!"

As the debate rages on, both sides will be lobbying federal, state, and local government to try to win support. For now, though, this battle is still too close to call.

Handout 6.4: The Battle over Dolphin Bay

Discussion Questions

List the reasons people are in favor of and against the proposed resort. (Divide your paper into pros and cons).

List any additional pros or cons you can think of that were not presented in the article.

Discuss some of the steps your group would take to help the community reach a decision about whether to develop the island. (Would you talk to more people, hire consultants, or take any other steps?)

Try to devise with some workable compromises. List your ideas and discuss the feasibility of each one. Can you think of an example of a coastal dilemma where compromise would not be in the best interest of the community?

What conclusion can your group make about the problems associated with developing coastal areas?

Drawing Political Boundaries

Debbie Lange and Bill Sands

7

Introduction:

The design of this activity is to help students understand the difficulty of drawing boundaries and some of the disputes that can occur. Present students with a problem-solving dilemma that in many ways replicates problems faced by actual boundary-makers. The students must partition Texas into five separate states. As in most real-world situations, no solution is perfectly fair. Natural resources are distributed unevenly, and ethnic groups are intermixed. The students will learn some of the problems that have occurred in real-life situations, such as in Europe at Versailles after World War I, in the Middle East after World War II, and colonial boundaries that were drawn in Africa and other parts of the world.

Grade level: 9-12

Time required: Three hours

National Geography Standards*: (Appropriate pages cited for standards, grades 9-12)

1. How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective. 184-185;
3. How to analyze the spatial organization of people, places, and the environments on Earth's surface. 188-189
4. The physical and human characteristics of places. 190-191
5. That people create regions to interpret Earth's complexity. 192-194
11. The patterns and networks of economic interdependence on Earth's surface. 206-207

**Geography for Life: National Geography Standards*. 1994. Washington, D.C.: National Geographic Research and Exploration.

Objectives:

- Students will apply criteria for stable political boundaries.
- Students will take into consideration physical, economic, and cultural factors in making geopolitical decisions.
- Students will identify problems that arise when countries or groups have to cooperate.

Materials and Resources:

- Map of the Physical Regions of Texas (provided)
- Map of the Major Cities in Texas (provided)
- Map of the Physical Features in Texas (provided)
- Map of the Traditional Culture Patterns in Rural Texas (provided)
- Outline Map of Texas (provided)
- Economic Facts about Texas (provided)
- Arbingast, Stanley A., *et al.* 1976. *Atlas of Texas*. Austin: University of Texas Press.
- Boehm, Richard G. and Larry L. Bybee. 1989. *Glencoe World Geography: A Physical and Cultural Approach* (Texas Activity Workbook). Mission Hills, Calif.: Glencoe Publishing Company.
- Woyach, Robert B., *et al.* 1983. *Bringing a Global Perspective to World Geography*. Columbus: Ohio State University.
- Chapters 1, 2, and 11 of this site guide

The Learning Activity:

- *Background:*

If you have not done so before, introduce the students to the concept of a political boundary. Emphasize the fact that political boundaries can follow natural features or be imaginary lines, but above all they are artificial and arbitrary. Discuss the historical background and the sources of information provided in the case of Texas. Make sure the students understand that the goal of the delegates is to obtain the best partition possible for their areas.

- Executing the activity:

Divide the class into three or more groups, with each group having at least six representatives. Using the maps provided, allow the students to choose an urban area to represent, making sure that each physical region is represented. The urban areas may vary, and the cities along the Balcones Escarpment may represent the Central Lowlands (Fort Worth, Waco, and so on), the Central Hills (Austin), and the Edwards Plateau (San Antonio, Laredo). Each group needs to elect a leader or spokesperson and a cartographer. Each group should discuss and decide on a boundary for their fictitious state. The delegates should try to anticipate the arguments for each division. The groups will map their solutions on the Texas outline map. The symbols for each new state that might be depicted on the map include: a state name, a flag, a song, a tree, a flower, a motto, and so on. Also, remember TODALS when drawing the map (T=Title; O=Orientation; D=Date; A=Author; L=Legend; S=Scale). Ask each group to present its proposed boundaries and the reasoning behind them. Allow between 5 and 10 minutes for each group. Since conflicting boundary claims will be inevitable, have the groups vote on compromise boundaries and record the vote. An alternative idea would be to select a neutral Boundary Commission (such as the United Nations Boundary Commission) or a group to represent the state legislature. Groups would then present their proposals to the commission. The commission would then decide on a final solution and present its arguments to the groups.

- *Concluding the Activity:*

Discuss the simulation with the class, drawing attention to real situations that are similar, such as Israel and Palestine, Central Europe, Southeast Asia, and Africa. You may wish to discuss some of the following:

-What problems occurred within your groups?

-What problems did you have in deciding where to draw the boundary?

-Should boundaries necessarily follow natural features?

-Should members of a state be culturally or ethnically similar to each other? If they are not similar, what problems might be faced in the future?

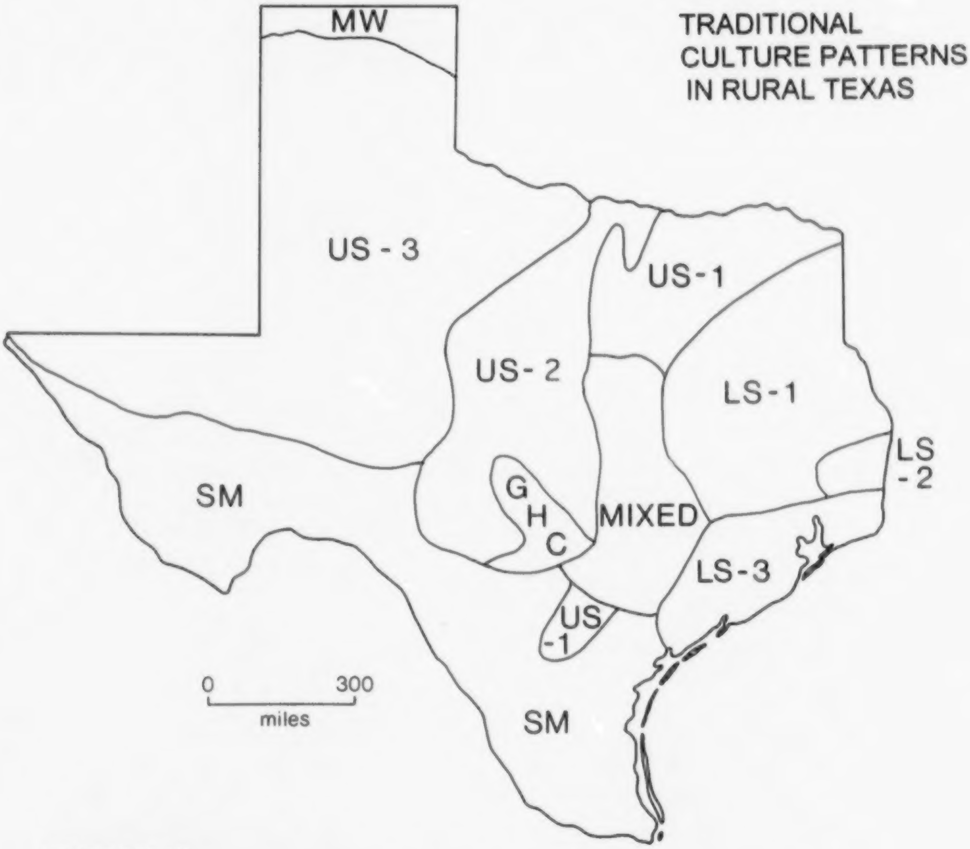
-What problems arose when you tried to divide the resources equitably between the various groups? Is there a solution that is good for all parties involved?

-Is the best solution to divide Texas into five states? What would some other solutions be? What would be some negatives and positives for this action?

Extensions:

- You can change this activity to fit any state in the United States. The teacher (or students) would need to gather pertinent information, such as the location of physical regions, resources, and population distributions for the state and then proceed with the activity for that state. Some states might want to divide into fewer divisions. Smaller states may want to think about borrowing land from neighboring states when creating new states.
- Have each group compose a multimedia presentation of each new fictitious state. Ideas include using Aldus Persuasion or Hyperstudio, multimedia encyclopedias, Internet, and other technologies. If these advanced technologies are unavailable, you can substitute overheads, posters, and 35 mm slides with music. Explain to students that they are presenting this information to their state legislature in an attempt to sell their proposal.
- Have your class divide into groups of six, and allow them to re-draw the boundaries of the 48 continental United States into 13 new states. The name of each new state could reflect a physical feature or cultural phenomenon in that area. Each group could draw the new boundaries and names on an overhead with the United States outline on it. Have a spokesperson from each group explain the reasons for the new boundaries and state names.

Handout 7.1: Source: After, *Atlas of Texas*, Arbingast, Slanley A. *et al.*
Austin Bureau of Business Research, University of Texas at Austin 1976.



LOWER SOUTH

LS-1	Plantation aristocracy (large numbers of rural blacks, deep southern dialect, traditional emphasis on cotton).
LS-2	Badland poor whites (few blacks, deep southern dialect, traditional subsistence economy).
LS-3	Coastal prairie (plantation aristocracy overlaid with later immigration of midwesterners and Europeans) major Louisiana influence, including some French.

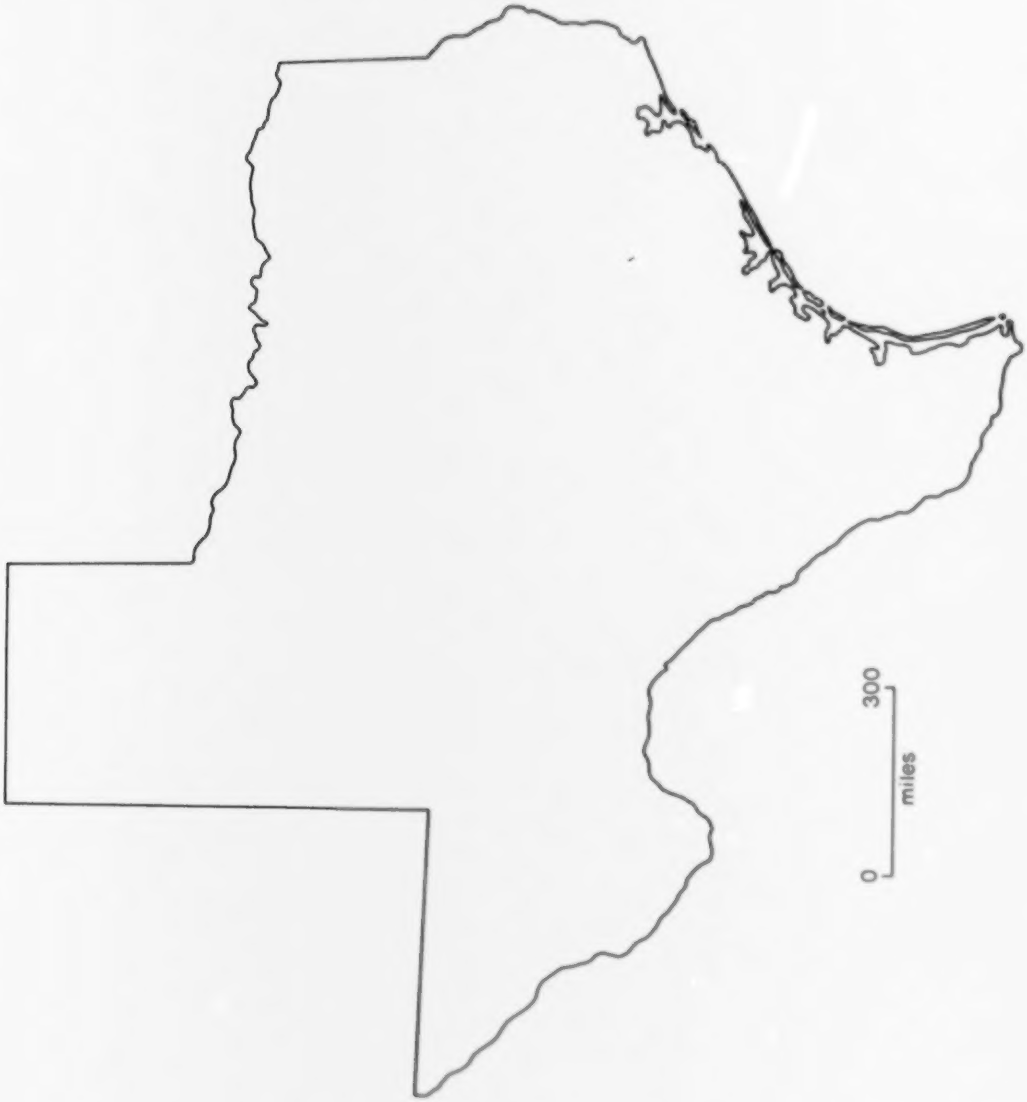
UPPER SOUTH

US-1	Middle-class upper southerners (zone of primary expansion from Tennessee, Kentucky, and Missouri; market-oriented grain and cotton farming).
US-2	Appalachian hill folk (zone of primary expansion from the Ozarks and Appalachians, traditional subsistence economy).
US-3	West Texas (zone of secondary upper southern expansion, derived from zones US-1 and US-2).

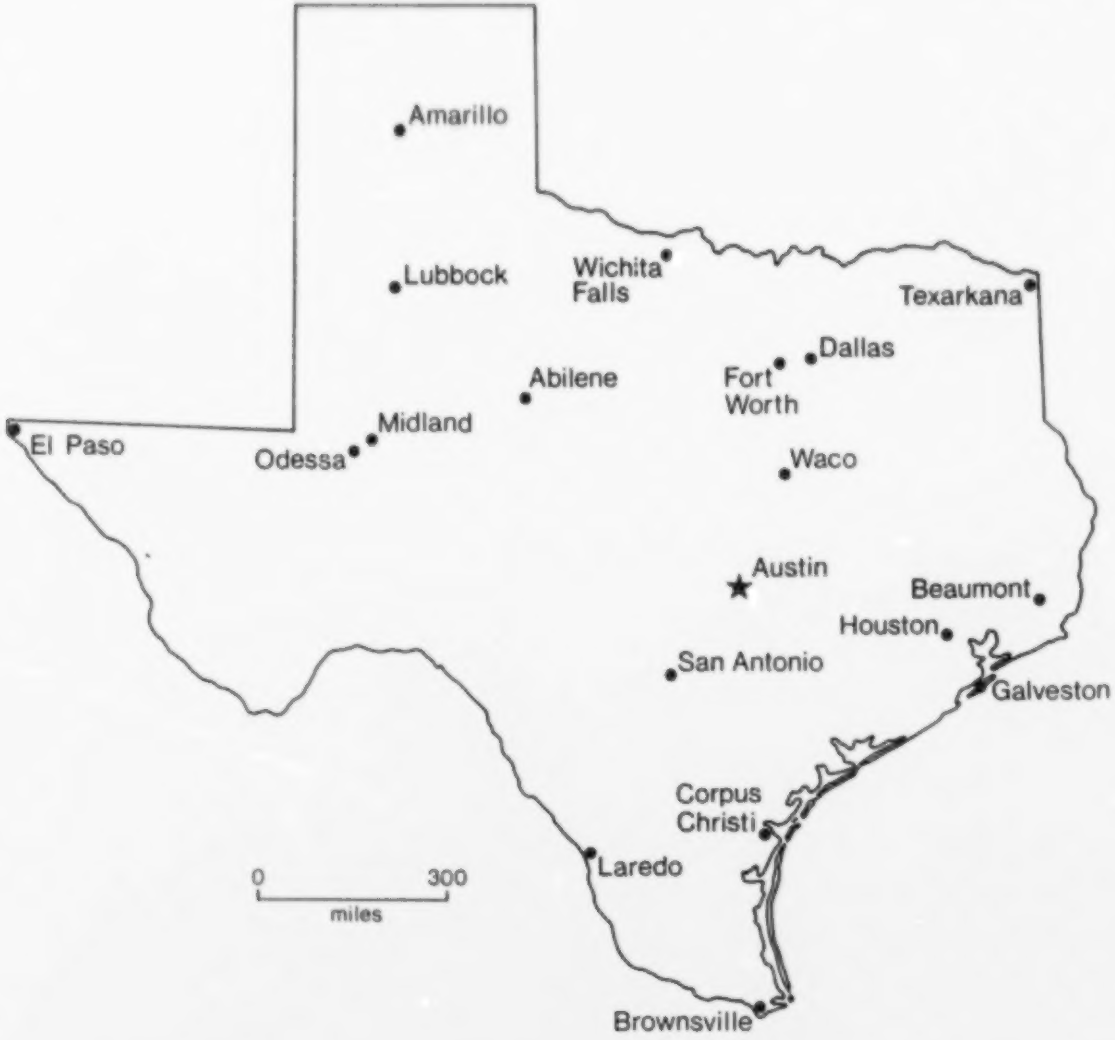
OTHER

SM	Spanish-Mexican (Latin-American culture area, with overlay of Anglo traits).
MW	Midwest (predominance of midwestern traits, including Republican voting strength and Methodist strength).
GHC	German Hill Country (heavily Teutonized, with an overlay of upper southern traits).
MIXED	Zone of thorough mixing of European (especially German and Czech), upper southern (US-1), and lower southern (LS-1), with none predominant.

Handout 7.2: Outline Map of Texas



Handout 7.3: Major Cities in Texas



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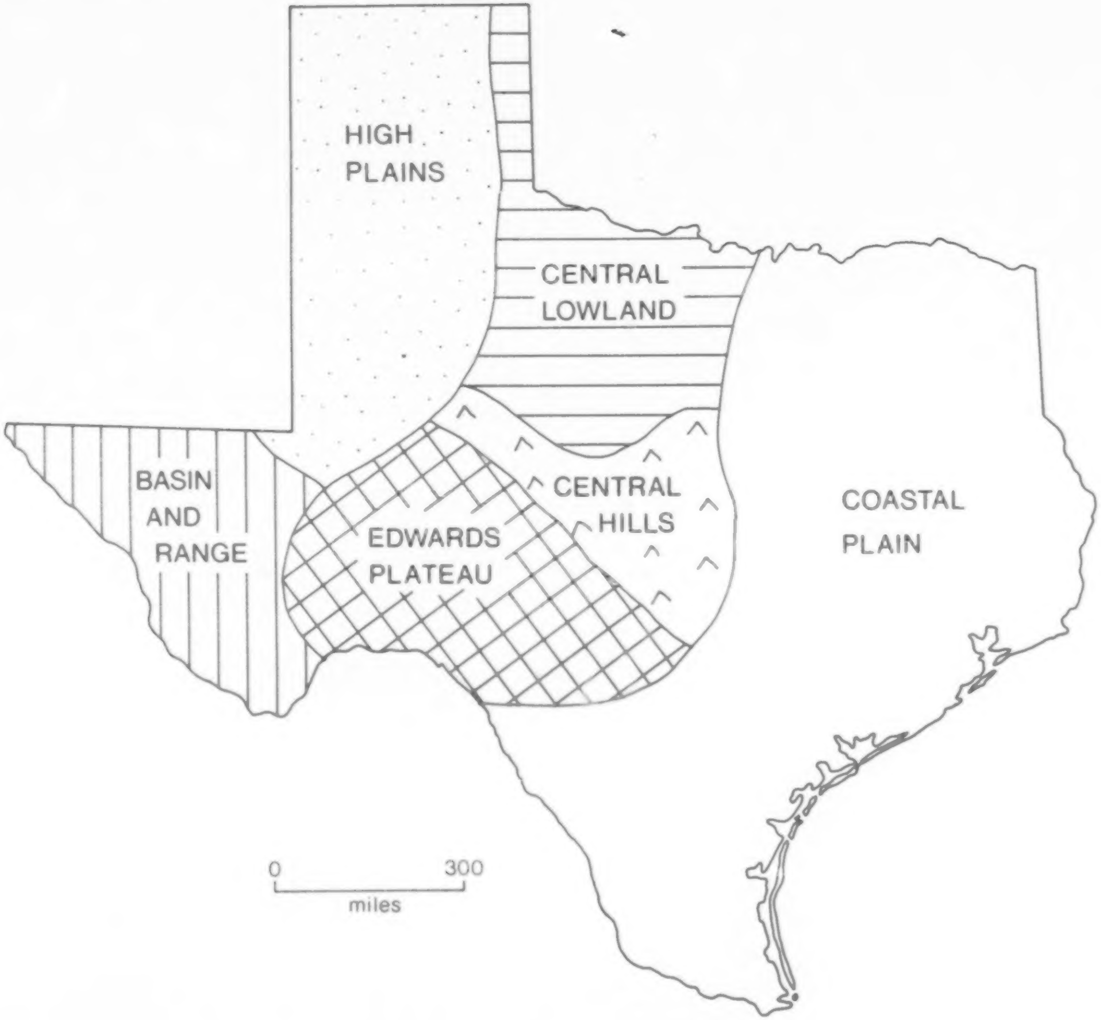

Handout 7.4: Physical Regions of Texas

163

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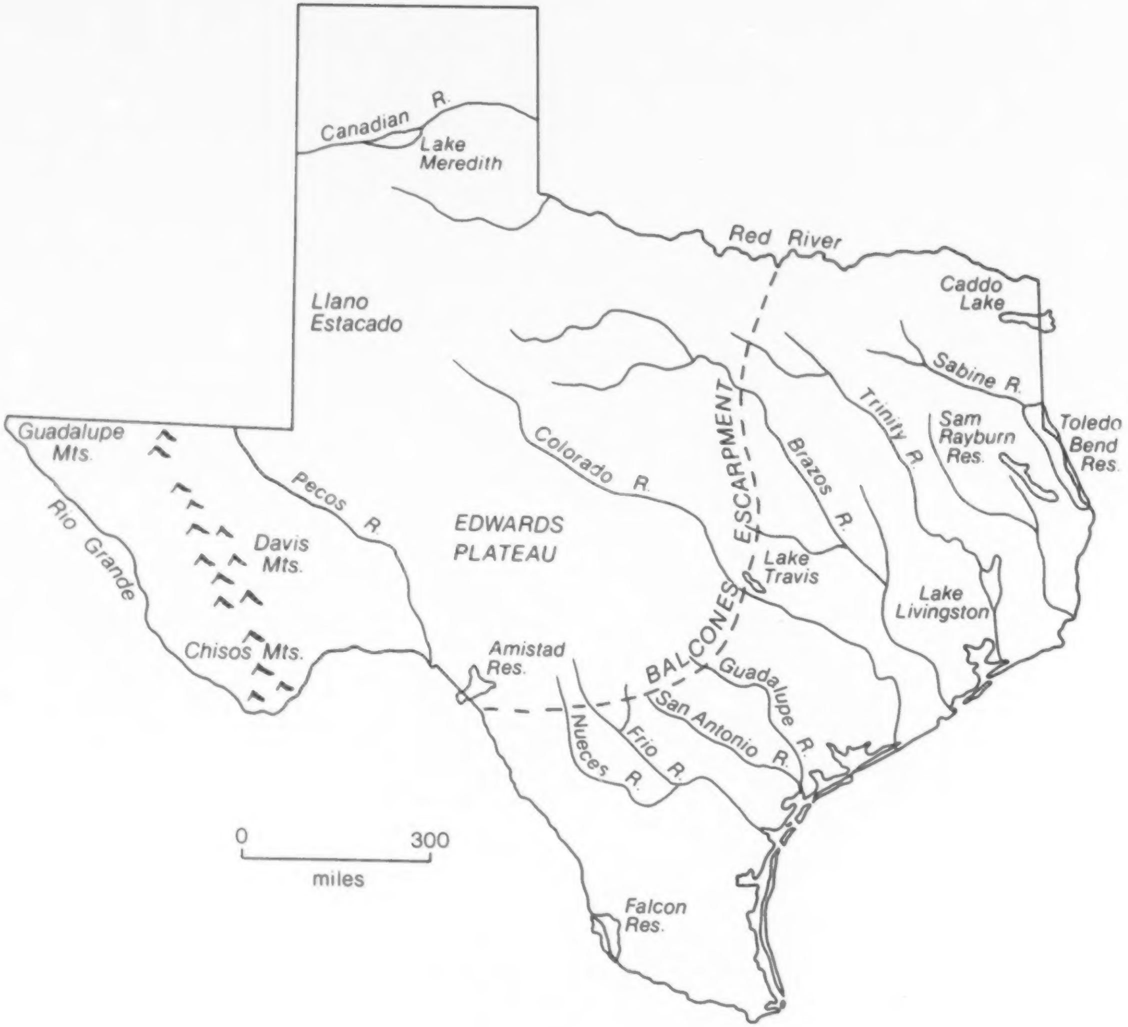
Handout 7.5: Physical Features in Texas



Handout 7.6: Economic Facts about Texas

The Coastal Plain is the largest region in Texas. It is also the center of much economic activity. Austin, the capital of Texas, is located in this region.

Fishing is an important industry along the Gulf Coast. South Texas has long been a ranching center. The Lower Rio Grande Valley in far South Texas is known for the many fruits and vegetables grown there. Rice, cotton, and grains are grown along the coast from Houston southward to Corpus Christi. The East Texas area produces a great deal of lumber, cattle, and poultry. Farther west on the Coastal Plain, farmers produce cotton, grains, and cattle.

The three largest cities in Texas–Houston, Dallas, and San Antonio–are located on the Coastal Plain. Houston is the center of petrochemical industry. It is also a large seaport. Dallas is a financial center. It also has a strong high technology industry. San Antonio is an important military training center.

Central Texas stretches from the Panhandle to the Rio Grande through the vast midsection of the state. The land ranges from belts of low hills to plateaus and low mountains as high as 3,000 feet (900 meters).

The Central Lowland occupies a narrow strip on the eastern edge of the Panhandle, but most of the region is in a broad swath south of the Red River to the Central Hills. The Central Hills, also known as the Hill Country, are in the geographic center of Texas. To the south and west, running all the way to the Rio Grande, is the Edwards Plateau.

Cattle are raised in the far northern part of Central Texas, along the Canadian River. In western portions of the Central Lowland and Central Hills, farmers grow cotton, grains, pecans, peaches, cattle, sheep, and goats. In the eastern parts of these regions are found dairy cattle, peanuts, and oats.

The Edwards Plateau is a rocky, hilly area. Parts of it receive little rainfall. Ranchers raise cattle, sheep, and goats there.

Central Texas has a limited population. Wichita Falls is the largest city in the region. Other important cities are Abilene and San Angelo.

The High Plains Region occupies most of the Texas Panhandle. Most of the land in the region is quite flat. However, the elevation is higher than that of lands to the east. In general, the elevation rises as one travels from southeast to northwest in the region. The eastern edge of the High Plains is marked by a steep escarpment called the Cap Rock.

In the southeastern part of the High Plains is a rich oil-producing area called the Permian Basin. The cities of Midland and Odessa are the business centers of this area.

In the northern High Plains, the main crop is wheat. Many cattle are also raised here. Amarillo and Lubbock are the main cities. To the southeast, along the Cap Rock, is an area of rolling plains and prairies where cotton and grains, particularly sorghum, are grown. The southern part of the High Plains region has many irrigated farms that produce cotton and grains.

The Basin and Range Region is the physical region of Texas located farthest west. This is the highest, most rugged part of Texas. Although large areas are covered by flat basins, about half the area consists of mountains. Some of the major mountain ranges are the Davis Mountains, the Franklin Mountains in El Paso, and the Chisos Mountains in the Big Bend National Park.

Few people live in the Basin and Range Region. There are few cities. In fact, about two out of three people in the region live in El Paso. El Paso is located near the point where Texas, Mexico, and New Mexico come together. El Paso is just across the Rio Grande from a large Mexican city, Ciudad Juarez. A great deal of manufacturing is carried on in plants located on both sides of the river. Many of these plants are part of the maquiladora program.

This region of Texas receives less rainfall than any other. However, agriculture is important in the Upper Rio Grande Valley, a narrow strip of land along the Rio Grande downstream from El Paso. Farmers produce cotton and alfalfa and raise dairy cattle on irrigated farms.

From: Boehm, Richard G. and Larry L. Bybee. 1989. *Glencoe World Geography: A Physical and Cultural Approach* (Texas Activity Workbook). Mission Hills, Calif.: Glencoe Publishing Company, pp. 6-9.